WETLANDS ARE NOT WASTELANDS

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WETLANDS ARE NOT WASTELANDS

APPLICATION OF WETLAND EVALUATION METHODOLOGIES TO THE MINUDIE DYKELANDS, NOVA SCOTIA

Atlantic Region Pilot Study

June 1989

Report
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Prepared for Sustainable Development Branch,
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By Peter Stokoe, Jane Roots and Brad Walters,
Dalhousie University, Halifax.

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PREFACE

This pilot study is part of a multi-year project being led by the Sustainable Development Branch, Canadian Wildlife Service and Wildlife Habitat Canada, with the assistance of CWS Regional Offices. The overall goal of the project is to demonstrate that wetlands are not wastelands.

The objective of the project is to develop and pilot test evaluation methodologies in order to identify current or new approaches which best show and incorporate the sustainable resource values of wetlands. Based on these activities a manual will be produced for use by provincial and local land-use planners and officials in the evaluation of wetlands and wetland change proposals.

Current methods of evaluating many resources inadequately portray their true environmental and economic value to society based on the functions they support. This is particularly true of wetlands, which, when threatened with conversion to other uses or with degradation, have been virtualy impossible to adequately value using the most common current methods of evaluation such as benefit-cost analysis. As a result, many good wetlands have been altered to other uses simply because their value to society cannot be adequately demonstrated and because comparative evaluation methodologies automatically favour other short-term, high-value uses of the land resource.

There is, however, an increasing body of scientific literature identifying the importance of the functioning of wetlands in their natural state in providing for specific benefits to society. These functions include water storage, sediment retention and nutrient recycling, as well as the provision of increased biomass energy, biological diversity and fish and wildlife habitat. Likewise, there is a recognition of the value of these functions to society for wildlife and nature conservation, active and passive recreation, commercial plant and animal production, extraction, risk reduction, research and education, and asthetics or landscape diversity, among others, by various governmental and other agencies. This recognition in turn has prompted the development of conservation-oriented initiatives.

In response, this project has focussed on the development and testing of alternative procedures and evaluation methodologies which more adequately portray the true values of wetland resources. To do this, it is necessary to evaluate, adapt and develop methodologies, pilot test them on partiular wetland problems, involve a wide spectrum of involved groups or individuals in the verification of the validity of such methodologies, and ultimately produce a manual backed by a broad consensus which can act as a guide to provincial and local land-use planners and decision-makers for appropriate evaluation of wetlands when they are involved in a planning decision process. The major steps in the project are listed below:

a) Based on a workshop focussing on alternative methods of evaluating renewable resources (Manning and Cox, 1986), a short list of potential approaches to the evaluation of wetlands has been developed. These include:

1. an approach based on willingness-to-pay for wetland values and functions;

2. an opportunity cost approach to be applied to measurable wetland values and to the proposed alternate use; and

3. a cumulative impact approach synthesizing a broader range of social goals and objectives than those generally encompassed by the term "economic".

b) The three alternative methodological approaches have been described in detail and the conceptual context of each is provided in the report "Wetland Evaluation: Methodology Development and Pilot Area Selection" (Bardecki, 1987).

c) The three selected methods have been tested in four pilot studies across Canada - the current stage of the project. The four case study areas are the Minudie Dykelands, Nova Scotia; the Greenock Swamp, Ontario; the Prairies Pothole region, Saskatchewan; and the Cowichan Estuary, British Columbia. The sites have been chosen to allow for testing applicability of the methods using a variety of types of wetlands. This report provides the results of one of the pilot studies.

d) Based on the results of the case studies a draft manual will be developed for application to the planning of the use of wetlands. It will include a discussion of the functions and values of wetlands, and the presentation of a range of approaches and methodologies appropriate to the evaluation of wetland values and their incorporation into the planning decision process. An expert committee will evaluate the pilot study results and advise on the particular directions for the manual and its contents.

e) A conference of involved individuals from the planning community, wildlife community, agriculture, etc., will be held to engender broad based support for the manual as an appropriate method to be applied whenever wetlands use and management are in question. At a minimum, the manual should serve as a broadly based reference document for use by all decision-makers dealing with wetland conservation or conversion.

ACKNOWLEDGEMENTS

Overall, management of the project has been provided by a National Steering Committee comprised of Ken Cox, Wildlife Habitat Canada, and Edward W. Manning, Wayne Bond, Gerry Lee, and Fern Filion, Canadian Wildlife Service. Funding for the pilot studies has been provided by Wildlife Habitat Canada and the Sustainable Development Branch of the Canadian Wildlife Service.

Management of the individual pilot studies (except Greenock Swamp) has been undertaken by the respective regional office of the Canadian Wildlife Service. Scientific authorities for the pilot studies were:

Minudie Dykelands	**Joe Arbour, CWS, Atlantic Region**
Prairie Potholes	**Dave Gierman, CWS, Western and Northern Region.**
Covichan Estuary	**Ken Redpath, CWS, Pacific and Yukon Region.**

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CHAPTER 1
INTRODUCTION

In its prescriptive role, economics is concerned with where resources should be allocated to produce the greatest net social benefit, and what conditions are necessary for this to occur. As a starting point, net social benefit is usually defined as the sum of benefits to each individual (measured in terms of how much they would be willing to pay for those benefitis, or how much they would have to be compensated to forgo those benefits, where this is more appropriate) minus the sum of costs to each individual (measured in the same terms). A basic theorem of economics states that net social benefit, defined in these terms, is maximized in an economy mediated by perfectly functionning markets.

In practice, markets may work well in taking account of some benefits, but fail in taking account of others. Markets do quite well in taking account of the social benefits of agriculture, in terms of the prices that people are willing to pay for agricultural products. Similarly, markets do quite well in taking account of the social benefits of land for residential use, in terms of how much people are willing to pay for that land for their own use. Markets work less well, or fail completely, where social benefits may be large but diffuse, so that little of these benefits can be "captured" by the landowner either directly (as in the case of residential use), or indirectly, through prices received from products of the land (as in the case of agricultural use).

In particular, markets do not work well, or fail completely, to take account of some important and pervasive social benefits of land uses, such as filtration and purification of water, flood control, outdoor recreation and production of wildlife. While these benefits are associated to greater or lesser degrees with most land uses, they are especially well served by wetlands. Because it is difficult or impossible to market these benefits, however, there has been little incentive to maintain wetlands in their natural state, and, until recently, people even tended wrongly to consider wetlands as unproductive wastelands.

In the meantime, more than 80% of wetlands have been converted to other uses in some parts of Canada, especially where there has been heavy pressure for such conversion to residential or agricultural uses. This was the case in the Chignecto wetland area on the border between Nova Scotia and New Brunswick (Map 1.1). The wetlands of the Chignecto area are considered to be of major importance for wildlife conservation in the Atlantic Region because they provide important stopovers on the Atlantic flyways of migratory birds. The draining of these wetlands, and other wetlands on the Atlantic flyway, is considered to be a major factor in the severe population decline of some species.

Historically, maintenance of the Chignecto wetland habitat has had to compete with agricultural uses of the area. Acadian, and later English, settlers dyked a large fraction of the saltmarsh in the 17th and 18th centuries. Hay production generated increasing demands on the land until the internal combustion engine replaced horses as the primary means of draft and locomotion. Since then, there has been a decline in the area of land in agriculture, and decreasing intensity of use, which has allowed a growing area

to become available for wetlands and wildlife conservation. The Canadian Wildlife Service (CWS) has acquired saltmarsh and freshwater marsh for this purpose. CWS, provincial agencies and Ducks Unlimited Canada have also created, restored and maintained freshwater marsh. Nevertheless, only about a fifth of the land that was dyked has been restored to some kind of wetland (Environment Canada, 1986).

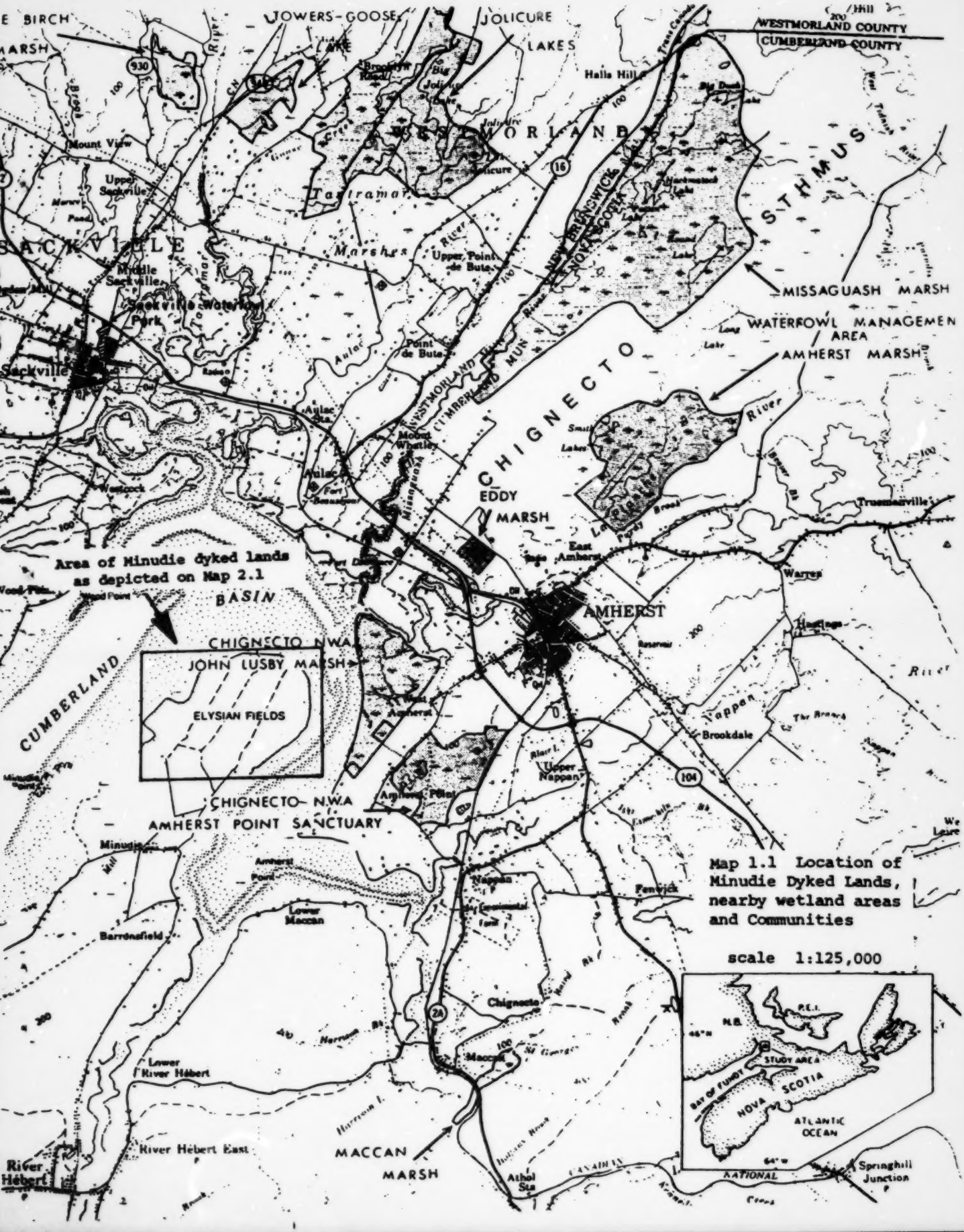
To address the general problem of how to ensure that the social benefits of wetlands are properly considered in decision-making, Wildlife Habitat Canada and Environment Canada have instituted a research project entitled "Wetlands are not Wastelands". The purpose of this project is to formulate and test methods for evaluating the social benefits of wetlands. Such evaluation is important not only in justifying the protection of wetland areas, where appropriate, but also in assigning priorities and effort to the protection of wetlands according to the social benefits which they provide. In some areas, such as the study area for the present report, not only protection but restoration of wetlands may be needed.

Three methods of wetland evaluation have been formulated for the "Wetlands are not Wastelands" project: Willingness-to-pay, Opportunity cost, and Cumulative Impact Assessment. These methods are now being tested by application to sites in four regions across Canada: the Atlantic Region, Ontario, the Prairies and British Columbia. This report documents the results of the Atlantic Region case study.

For the Atlantic Region case study, the site selected was the Minudie dykeland or Elysian Fields (Map 1.1), an area of just over 1,000 hectares in the Chignecto area. This area was saltmarsh and tidal mud flats before it was dyked about two hundred years ago. Most of the Minudie dykeland is now Nova Scotia crown land. By agreement between Environment Canada and the Nova Scotia Department of Agriculture and Marketing, which administers the land, it was decided to evaluate a scenario for multiple use of the Minudie dykeland, including some continuing agricultural use, as well as establishment of freshwater marsh on part of the land.

While the focus of the Minudie dykeland study is similar to that of the studies for the other regions, the application of the methodologies to the Minudie Dykelands differs, in that we are here considering not potential alienations of wetland to other uses, but conversion of land now in other uses (in this case, agricultural uses) to wetland.

This report begins by surveying the current and potential uses of the Minudie dykelands, and the costs of these uses (Chapter 2). Chapter 3 distinguishes the socially valued functions of the alternative land uses in providing both products and environmental services. Chapters 4, 5 and 6 discuss the approaches taken, and the results obtained, in the applications of the Willingness-to-pay, Opportunity cost and Cumulative Impact Assessment methods respectively. The applications of these methods follow on from the the distinction of socially valued functions in Chapter 3, and there is some overlap among the methods. In general, the methods differ according to the breadth of issues which they incorporate, expanding in breadth from the Willingness-to-Pay to the Cumulative Impact Method, but relinquishing simple quantification accordingly. Chapters 7 and 8 present conclusions and recommendations respectively from the applications of the methods, including critiques of the methods themselves.



Map 1.1 Location of Minudie Dyked Lands, nearby wetland areas and Communities

scale 1:125,000

CHAPTER 2
CURRENT AND POTENTIAL USES OF THE MINUDIE DYKELANDS

2.1 Current Investments and Land Uses

From an economic perspective, the best use of the Minudie dykelands is the use which yields the greatest net social benefit. The opportunity cost of any other use is the value of this greatest net social benefit which is forgone. Therefore, to determine the best use of the Minudie dykelands, and the additional value of this use over alternatives, it is necessary to consider all current and potential uses.

The Minudie Dykelands encompass approximately 1,040 hectares or 2,600 acres. The soil quality and drainage are a result of the deposition of alluvial sediments from the Cumberland Basin before the area was dyked from the sea in the 18th and 19th centuries. As a result, the head of the peninsula where the most sediment was deposited, has much deeper and better drained soils than elsewhere on the peninsula. The more compact and less well-drained soils are found adjacent to the uplands and forested area. Approximately 100 hectares of the area has been formed, with some of the ditches dating back 30 years. The earlier ditches were dug at intervals of 65 feet while the more recent ditches are 150 feet apart.

In terms of current dollars, the capital investment on agricultural development of the Minudie Dykelands has been estimated as follows (Kolstee, 1989):

$238,000	dyke construction @ $7/linear foot
$260,000	aboiteau construction
$120,000	main ditching
$ 45,000	road construction (approx. 30,000 feet)
$158,000	fencing (approx. 30 miles)

Expenditures by the Nova Scotia Department of Agriculture on maintenance of dykes, aboiteaux and roads, and on drainage for the last twenty years are given in Table 2.1. These indicate maintenance costs of approximately 1.5% of the capital investment per year.

The better drained, landformed areas toward the head of the peninsula have been used for hay production. The less well drained lands toward the uplands and forested area have been used as private and community pasture.

Only about 100 hectares of the Minudie Dykelands is privately owned; the rest is crown land of Nova Scotia, administered by the Nova Scotia Farm Loan Board. Until last year, most of the farming activities were conducted by Elysian Farms, which leased land from the Farm Loan Board for hay production and pasture. Elysian Farms ceased operations last year, and there was no agricultural product from the land. A new proprietor is currently taking over the farm, and planning future production.

The main limitation of the Minudie Dykelands in terms of further agricultural development or improved wetland management has been the isolation of the area. The nearest major highway (the Trans Canada Highway) and nearest town are at Amherst, Nova Scotia. Although the Minudie dykelands are less than 10 km away from Amherst as the crow flies, the road distance is almost 50 km. All but the last 3 km of the road to the Minudie dykelands is paved, however.

MINUDIE MARSH N.S. 54

Year	Maintenance (dykes, aboiteaux, roads)	Drainage (Main)
68	155.00	
69	929.00	
70	2,471.00	
71	238.00	
72	945.00	
73	4,665.00	
74	3,790.00	
75	6,723.00	
76	3,121.00	
77	5,416.00	
78	21,316.00	
79	599.00	21,996.00
80	9,897.00	23,887.00
81	6,242.00	8.081.00
82	3,532.00	11,968.00
83	1,997.00	5,892.00
84	35,026.00	1,657.00
85	40,382.00	
86	18,109.00	
87	4,269.00	
88	1,315.00	
	171,137.00	73,481.00
	$8,149.38/year $2.78/acre-year	$3,499/year $1.35/acre-year

Table 1.1 - Expenditure for maintenance and drainage on the Minudie Marsh by the N.S. Department of Agriculture and Marketing, 1968-1988 (Source: Hank Kolstee)

2.2 Potential Agricultural Uses

The soils of the Minudie Dykelands are part of the Acadia soil complex (Nowland and MacDougall, 1973). They are considered to be fertile, requiring little use of added fertilizers, as long as they are limed occasionally to reduced the acidity which builds up in the surface layers as they are leached by precipitation. Although they compare favourably with upland agricultural areas in terms of fertility, they have a disadvantage in that the high clay content of the soil makes it of low permeability to water, so that the dykelands take longer than upland areas to drain in the spring before they can be worked with agricultural equipment; the growing season is thus effectively somewhat shorter. The viability of agricultural uses of the dykeland depends on the size of the markets in which its agricultural products can be sold. There are several possibilities for agricultural development in the area:

Hay production: Hay production has generally been for on-farm use, although there is also a market for hay. Maritime hay producers have also been trying to export hay to other markets. At current farm prices of just over $60 per ton (N.S. Agricultural Statistics, 1988), hay production yields little or no profits. In the export market, prices of up to $200 per ton have been obtained for good quality hay, although costs of processing and transportation must be incurred in this case. Although there was recently optimism about possibilities for new and expanded export markets for hay, this optimism now seems to have waned. It is unlikely that hay prices will ever again reach the levels of the hay boom in the early decades of this century. Consequently, the value of land for hay production for sale will continue to be low.

Dairy farming: The viability of expansion into dairy farming is restricted by the provincial dairy quotas. At the present time these quotas are being met and there is little likelihood of increases in the quotas in the near future.

Pasture: The Minudie Dykelands have been used for community and private pasture in the past and these endeavours have been successful. The soil and drainage of the Minudie Dykelands make this a viable use of the area although to get maximum benefit, further fencing and road construction would be required. Fencing is a one time cost and does much to sustain and improve the forage quality. As noted above, there has already been construction of approximately 30 miles of fence, representing a capital investment (in current dollars) of about $158,000; similarly, there has been a capital investment of approximately $45,000 in about 30,000 feet of road.

Beef farming: At the present time, the cost of raising beef as compared to its market value does not make expansion into this area economically attractive. Raising beef on a small scale is considered marginal at present market prices despite the fact that Nova Scotia is only 25% self-sufficient in beef production. Much of the cost of raising beef is in the cost of winter feeding which is dependent upon imported grains. Central and Western Canadian producers have a comparative advantage in this regard.

Sod Farming: There is only one sod farm in production in Cumberland County at present. The market for sod is primarily local and for now, this small market is saturated. Sod farming is relatively profitable on dykelands as very little fertilizer is needed. However, sod farms can require herbicide use which may have a negative impact on wildlife in the area. In addition, sod

farming may have further negative impacts on wildlife in that it is a monoculture which reduces both the quantity of suitable habitat, and the quality of habitat, which is associated with landscape heterogeneity. As long as demand is met from current sources, which are closer to their markets, *there is little likelihood that the Minudie dykelands will be brought into sod* production.

Seed Farming: Seed farming might benefit the most from the isolation of the Minudie Dykelands. In order to keep seed crops free from contamination from other commercial agricultural crops, it is necessary for seed farms to be isolated from other farming activities. On the negative side, however, the lack of variety afforded by the Minudie dykelands in soil and hydrological conditions, and and in exposure to sun and weather, limits the variety of crops for which the Minudie dykelands can provide optimal conditions. Establishing a seed farm would have to be undertaken with due consideration of the market for seeds. At the present time there is only one seed producer in the region, located on Prince Edward Island.

2.3 Potential Wetland Conversions

The potential for wetlands on the Minudie Dykelands is dependent upon the biophysical factors which exist in the area as well as socio-cultural factors which determine the uses and value placed on wetland amenities.

Biophysical factors: The drainage patterns and the proximity to standing or open water make some areas of the Minudie Dykelands more conducive to wildlife and wetland development than others. For example, the poorer drained soils adjacent to the uplands could provide good quality freshwater marshland. Experience with other freshwater wetlands in the Chignecto area suggests that a managed freshwater wetland on the Minudie dykelands would not have the problem, found on the Missaguash and Tantramar marshes, of mats of cattails and other vegetation forming on the marsh and reducing waterfowl habitat (personal communication, Keith McAloney, Provincial Biologist, Ducks Unlimited Canada). This problem is a function of the organic content of the soils. The low organic content of the Minudie dykeland soils would result in little or no problems with floating mats, while the fertility of the soil would be conducive to a high level of a kind of primary productivity that would in turn support a high level of productivity of wildlife, especially waterfowl.

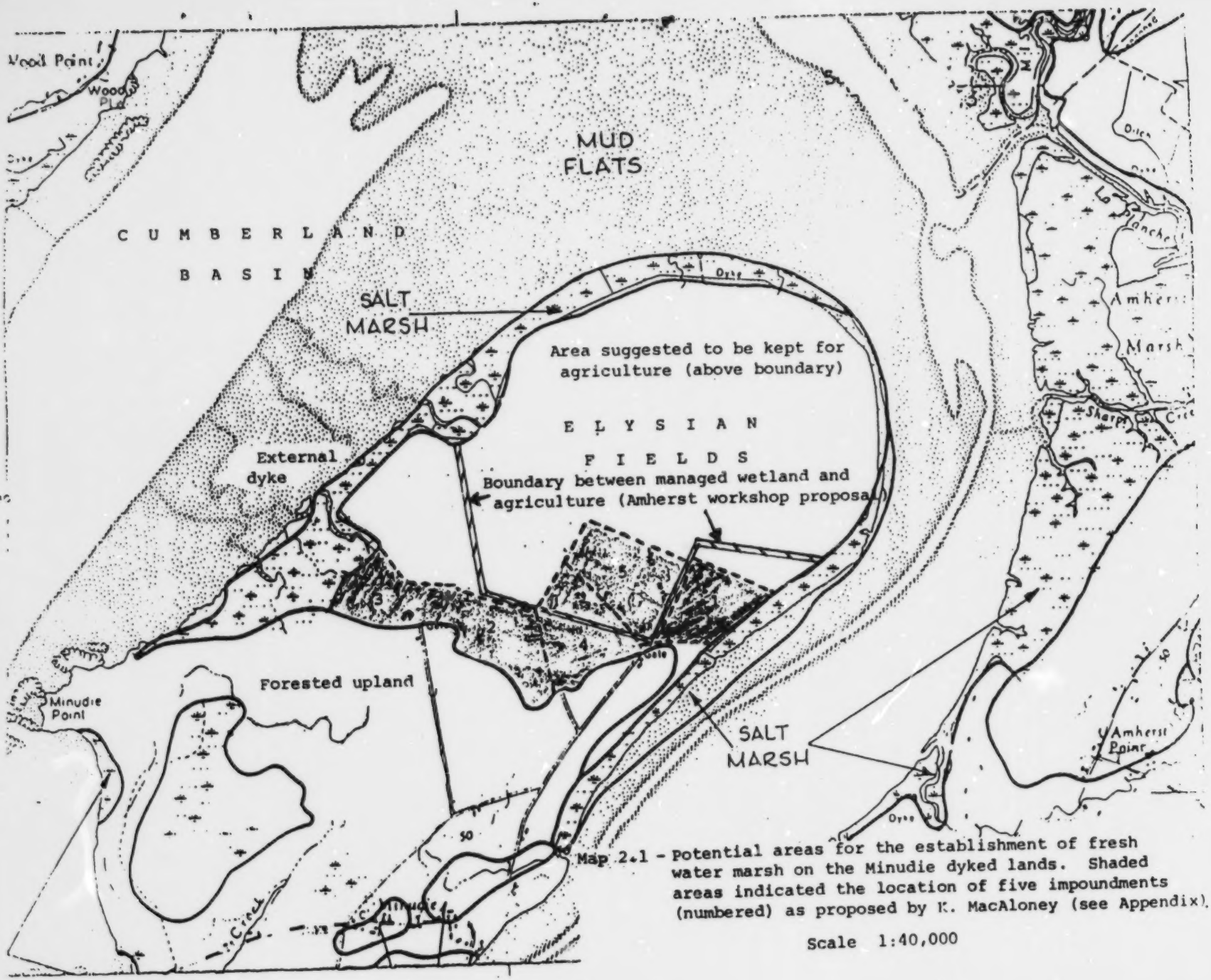
Although landscape heterogeneity in the Minudie Dykelands is considered low, the proximity of several adjacent habitats, i.e. saltmarsh, open salt water and mud flats as well as some forested uplands, provides a landscape matrix that is essentially different from any other existing wetlands in the Chignecto area. In this sense, the Minudie Dykelands are more valuable to shorebirds and some waterfowl that utilize these habitats. The distance from the Minudie Dykelands to the local uplands across the water (0.5 miles to Amherst Point) is not considered significant to those species that may benefit from nesting and feeding in both areas. Alternative wetland developments in the Minudie Dykelands include pot-holing for individual breeding pairs of waterfowl, brackish water impoundments for staging habitat, and plugging of farming drainage ditches to create fresh water standing streams.

Socio-cultural factors: The potential of wetland development in the area also depends upon the benefits derived from such uses and whether such developments are viable from a management perspective. The Chignecto area contains

numerous protected areas under different forms of legislative jurisdiction, both federal and provincial, including three National Wildlife areas and numerous provincial game sanctuaries. The importance of the majority of these sites for wildlife conservation is not so much for the protection of endangered species but rather for the protection of high concentrations of shorebirds and waterfowl. The existence of wetlands in the Chignecto area which are more easily accessible from population centres, and already offer opportunities for wildlife observation, hunting and other recreational activities reduces the potential benefits of the Minudie Dykelands. The isolation of the Minudie Dykeland could be an obstacle in attracting local people as well as visitors to the area. Some public promotion of the area may be required in order to realize substantial use benefits. One form of institutional arrangement which might be consistent with these considerations may be some form of hunting resort or game farm under community management.

In order to derive information from knowledgeable people, and better define the scenario to be considered in this study, a workshop was held in Amherst on 6 February, 1989. At this workshop, an area of less well drained land, comprising about a third of the total area of the Dykelands, was suggested as most suitable for potential development as freshwater marsh (Map 2.1). Mr. Keith McAloney, Provincial Biologist of Ducks Unlimited Canada, has indicated a potential wetland development, and costs and benefits associated with it, on an area overlapping that indicated at the workshop (Appendix 1). This development would comprise five impoundments, with numbers on the map consistent with those in the Appendix.

It was beyond the scope of this study to explore the various alternative institutional arrangements for managing a multiple use area on the Minudie dykelands, and "marketing" the potential benefits of such an area. Suffice it to say that only a few resorts in the Maritimes are so far making any special effort to market themselves to hunters, or provide special services to support recreational hunting, although at least one resort operator who has ventured in this direction believes that there are potentially large numbers of hunters in the Maritimes and further afield who could be attracted by packages of services and hunting opportunities that can be provided here, if these are appropriately marketed (personal communication from Mr. Jim Duggan, Managing Director, Wild Goose Lodge, French River, Prince Edward Island). This prospect could allow some resorts to extend their business seasons from the summer through the autumn, and thus increase their viability by extending the number of months each year in which they can operate, derive profits, and provide employment. At present, hunters account for only small percentages of the business of hotels and motels in the Chignecto area (personal communications from hotel and motel operators). Establishment of even a small resort in the Minudie area (including River Hebert and Joggins) would require substantial development and marketing of other recreational attractions (e.g. fishing, boating, rock-collecting at Joggins, outdoor sports, etc.). Although these considerations have an important bearing on what proportion of the benefits of recreational use of the Minudies dykelands can be "captured" monetarily in the area, they are less important to the total social benefits *per se*, which this study endeavours to measure. Nevertheless, it bears investigation whether the combination of a resort in the Minudie area and a managed wetland on the Minudie dykeland might derive greater value from the dykeland than the value of its current use; this goes beyond the scope of this study to the economic geography of resort siting.



Map 2.1 - Potential areas for the establishment of fresh water marsh on the Minudie dyked lands. Shaded areas indicated the location of five impoundments (numbered) as proposed by K. MacAloney (see Appendix).

Scale 1:40,000

CHAPTER 3
PRODUCTS AND ENVIRONMENTAL SERVICES OF ALTERNATIVE USES

The rich soils of the Minudie Dykelands have high potential both for agricultural use and for managed wetlands for wildlife production.

The benefits from agricultural uses of the Minudie Dykelands can be considered to be measurable mainly in terms of returns from sale of the market products. The values of these products can be equated to their market prices (which indicate the marginal willingness-to-pay of consumers of these products), with the caveat that market restrictions (e.g. quotas), subsidies, etc. may distort prices from actual values. Costs can also be determined with the same caveat, although quantification of some costs (e.g. costs of a farmer's labour input) may be difficult. Net returns per unit area for each agricultural land use can then be calculated. Estimates of these values, and of the net benefits of a managed wetland, are provided in Tables 5.1 and 5.2.

The wetland or wildlife potential of the Minudie Dykeland is also considered to be very high. In some regards, a managed wetland on the Minudie dykelands could function as a "twin" to the wetland of the Amherst Point National Wildlife Area; as such, it could help to support larger populations or more regular occurrences of the wide variety of wildlife species found at Amherst Point, and thus provide greater assurance of the conservation of these species in the region.

Development of the wetland potential in the area would be managed with a view to the specific benefits desired. Wetland development of part of the Minudie dykeland could also yield marketable products. The following discussion first considers the marketable products which a freshwater marsh could yield, and then reviews the difference in environmental amenities and services which a wetland area would produce, relative to the same area in agricultural use. Some of these values are further quantified in chapter 5, and summarized in Tables 5.1 and 5.2.

Marketable products: Muskrat harvesting would increase in a managed wetland, bringing income to local trappers. Muskrat harvest is estimated at approximately 7.5 per acre per year (McAloney, 1989), with an average price of $5.00 each, yielding gross benefits of about $95 per hectare-year. Net benefits from this harvest would be the difference of gross revenues at this rate and the opportunity costs of the labour required to obtain this harvest. Some other fur-bearing animals, as well as muskrat (e.g. racoon, mink and fox) may also be harvested.

It is considered that a freshwater marsh located on the Minudie Dykeland would not be suitable for wild rice production, because wild rice grows best in slowly flowing water and the freshwater on the marsh areas would be practically still. In any case, the market for wild rice is now considered to be saturated.

Environmental services: These can be divided into the following different components:

Water quality: The water quality on the Minudie Dykelands is considered to be good and would be little affected, either positively or negatively, by

establishment of a freshwater marsh. The effects of chemicals used in agriculture on the Minudie Dykelands are considered to be negligible. Establishment of a freshwater marsh would have little effect on the export of organic material and nutrients into the Cumberland Basin marine ecosystem, and thus little effect on production of marine fish.

Toxics: There is very little known input of toxics to the area generally, given the limited need for pesticides and fertilizers, as well as the absence of intensive resource development or urban development.

Water quantity: The reduction of soil erosion and slowing of runoff from storms and thaws is a benefit derived from the wetland. Increased agricultural development in the area may require further ditching which would have minimal effect on water quantity.

Habitat: Developing the Minudie Dykelands for more intensive agricultural use could have an affect on the wildlife habitat. Habitat quality could be affected through adverse agricultural practices such as drainage ditches, monocultures and intensive use of pesticides. Habitat quantity could be affected positively by agriculture through the provision of nesting sites in tall grass and feeding areas, and could be affected negatively by additional drainage and road construction. Improved wetland management will take into consideration habitat requirements of desired species.

Wildlife: Some wildlife species would suffer local population declines in areas flooded by fresh water. These include terrestrial mammals (such as the meadow vole), field birds and several species of predatory birds. However, due to the abundance of existing hay/pasture habitats in the Chignecto area, these declines would not likely be regionally significant. Local populations of waterfowl, marsh birds and muskrat would increase substantially in the flooded areas. Based on survey and census data from other similar marsh habitats, waterfowl broods, marsh birds and muskrat populations would increase from essentially nil (the present levels) to high local densities of approximately 0.5-0.8 broods per hectare, 0.5 marsh birds, and muskrat populations as indicated above. Based on these densities, the overall marsh area of about 250 hectares could support approximately 120-200 waterfowl broods (720-1200 ducks), 120 marsh birds, and up to 4500 muskrat. Actual numbers would be influenced by the amount of management. For example, the smaller the freshwater impoundment, the higher the potential per area for waterfowl (and other wildlife) productivity. Considerations of cost effectiveness suggest impoundments of approximately 20 hectares in size. In general, the area of land provided for nesting areas should be equal to or greater than the area of water, and interspersion of habitats is preferable.

Rare or Endangered Species: Wildlife observers do not know whether any endangered species use or would use the area (Wildlife task group at the project workshop). It is unlikely that there are any species would make use of this area which do not already make use of the Amherst Point Sanctuary. The Minudie Dykelands gained some fame among naturalists last year with the visit to the area of a Eurasian kestrel (a species observed only a few times in North America). This event attracted naturalists from as far away as New England. It has been suggested (Al Smith, personal communication) that this bird may have been attracted to the Minudie Dykelands by an unusually large population of voles, which multiplied in the hay that remained unharvested last year.

Wildlife Use: Some indications of the existing and potential use of the Minudie dykelands for recreational hunting have been sought through a survey of sportsmen conducted as part of the willingness-to-pay component of this study. There is also some mushroom picking on the Minudie Dykelands (Hank Kolstee, personal communication); this is not likely to be adversely affected

by establishment of a freshwater marsh, except in those areas which are actually inundated.

Recreation: While agricultural development would likely decrease the quantity and quality of the recreational opportunities available on the Minudie Dykeland, there are also opportunities for multiple use of the area through landowner arrangements which might increase access to the area. Improved wetland management would also improve the recreation potential of the area. However, the accessibility of a number of other protected wetlands in the region to population centres, in comparison with the isolation of the Minudie Dykelands, may mean that the recreation potential of the area will not change.

Education/Research: The isolation of the Minudie Dykelands has affected the use of the area for research and educational purposes. Alterations to the area either through expanded farming activities or wetland improvements are unlikely to increase the use of the area for educational or research activities.

Uniqueness: The Minudie Dykeland is representative of the most recently deposited alluvial soils in the region. While the proximity of the dykeland to the mud flats is a special characteristic, there are several other protected areas in the region which have similar characteristics. The large area of fertile soil enclosed by the dykes (at relatively low cost per unit area) is a locally unique feature of the Minudie dykelands. The Minudie dykelands are also unique in that most of this large area is a single property, as crown land. Therefore, it is more feasible to consider large-area developments on the Minudie dykelands, because there would not be an initial requirement for land consolidation, which would be faced in considering such developments at other nearby, potential sites.

Quantity: Federal and provincial governments and Ducks Unlimited Canada have demonstrated an interest in expanding the area of managed wetland within the Chignecto region. The North American Waterfowl Management Plan, endorsed by the Canadian and American governments, calls for the protection of 10,000 additional acres (4,000 hectares) of migration and wintering habitat for black ducks on the east coast of Canada during the period 1986-2000 (Environment Canada, Canadian Wildlife Service, 1986).

CHAPTER 4
APPLICATION OF THE WILLINGNESS-TO-PAY METHOD

The willingness-to-pay method attempts to determine the value of environmental amenities by assessing the maximum amount (or "reservation price") that people would be willing to pay for that amenity. People may be willing to pay for an environmental amenity for their own use, for the option to use it in the future, for its social benefits generally, or simply for its very existence. Sometimes, the use value of an environmental amenity can be determined by considering the other expenditures that people are willing to make (e.g. travel to the site of the amenity) in order to use it. A more common way of attempting to determine each component of willingness to pay is by interviewing people to elicit from them the maximum amount they would be willing to pay if they had to pay for the amenity in a hypothetical or contingent market. This so-called "contingent valuation method" can raise many theoretical and practical problems, some of which are mentionned below. Nevertheless, this was the willingness-to-pay method adopted for the "Wetlands are not Wastelands" pilot studies.

4.1 Survey Groups

In order to determine willingness-to-pay for the services of a freshwater marsh area on the Minudie dykelands, a modified version of the contingent value method, as outlined by Bardecki (1987), was applied. In that the present study refers to a hypothetical wetland on the Minudie Dykelands, rather than an existing wetland, as in the other studies of the "Wetlands are not Watelands" project, there are some special considerations and potential problems with regard to content and conduct of survey interviews.

In the other studies of this project, it has been possible to designate a "user" as someone who uses the specific wetland under study. The most appropriate corresponding designation of a "user" in the present case is someone who believes that they will obtain additional value from use of the Minudie Dykelands if part of their area is converted to freshwater marsh. Survey formats based on such a designation are presented in Appendices 2-5. The first survey is a survey of the general public, while the second and third are surveys of two potential wetland user groups, sportsmen and naturalists. In addition, it was suggested at a meeting of the project steering committee that farmers should also be surveyed, to determine their perceived gains (in terms of wetland benefits) or perceived losses (in terms of diminished options for agricultural uses on the dykelands) from the establishment of a wetland area on the Minudie dykelands; this survey is attached as Appendix 5.

The general public survey (Appendix 2) was conducted by telephone with members of the public chosen at random, according to the stratification given below.

There are several identifiable potential user groups within the Chignecto region. There are two sportsmen groups:

(1) The Cumberland County Fish and Game Association has approximately 200 members and meets on the first Sunday of the month. The members of this group who attended their March meeting were asked to complete the sportsmen survey in writing.

(2) The Sackville Rod and Gun Club has approximately 115 members. This group was not surveyed.

There are also two groups with interests in natural history:

(3) The Chignecto Naturalists Club has approximately 30 members, and meets on the first Thursday of the month. The members of this group who attended their March meeting were asked to complete the sportsmen survey in writing.

(4) The Cumberland County Museum Association has approximately 200 members. This group was not surveyed.

There is another identifiable potential user group, namely the Nova Scotia Trappers Association. However, the benefits to this group were evaluated only in terms of net revenues from the market value of the animals which they can trap.

In addition to the above groups, Ducks Unlimited (Canada) attracts many members and contributors in the Chignecto area, including many from the above groups and from the general public. Because of the practical problems of surveying such a large, heterogeneous group, no such survey was conducted. The surveys of the smaller, more homogeneous user groups mentionned above, and of the general public were taken to suffice.

4.2 Stratification for General Survey

For the general survey of value-in-use and option and social values, eight communities were distinguished in the Chignecto area with residents having potential interest in a freshwater marsh on the Minudie Dykelands:

Community	Population (1986 census)	
Moncton, N.B.	55,500	
Sackville, N.B.	5,500	
Amherst, N.S.	10,954	
Maccan, N.S.	678	
River Hebert and Joggins, N.S.	1,851	
Springhill, N.S.	4,712	
Southampton, N.S.	209	(1981 census, 1986 N/A)
Miundie, N.S.	58	

These communities account for most of the population of the area, and include some rural population. There is some risk, however, that focus on these communities introduces some urban (vs. rural) bias. Nevertheless, this focus greatly simplifies the stratification if we assume that each of these communities is a point concentration of population, rather than having to consider a population distribution over the region. Such a focus also simplifies the telephone survey, because telephone numbers in the region are listed in sections of the telephone books for each of the above communities. Therefore, after determining the number of respondents to be surveyed in each community, that number can be selected at random from the corresponding section of the telephone book.

We consider that the residents of all of these communities have access to four major freshwater wetland areas (including, hypothetically, a freshwater marsh

with an area of approximately 300 hectares on the Minudie Dykelands):

Wetland Area	Approximate Area (hectares)
Tintamarre National Wildlife Area	1,990
Missaguash/Amherst Waterfowl Management Area	4,700
Chignecto National Wildlife Area	1,095
Minudie Marsh	300

The distance by road in kilometres between each community and each wetland area is as follows:

	Tintimarre	Missiguash	Chignecto	Minudie
Moncton, N.B.	50	63	59	102
Sackville, N.B.	10	23	19	62
Amherst, N.S.	25	15	4	47
Maccan, N.S.	40	30	11	32
River Hebert, N.S.	56	46	28	16
Springhill, N.S.	50	40	30	68
Southampton, N.S.	58	48	29	49
Minudie, N.S.	68	58	40	3.5

For the purposes of stratification, we estimate the probability P_{ij} of a person from community j visiting wetland i (if they visit any wetland) as:

$$P_{ij} = \frac{a_i / d_{ij}^{\lambda}}{\sum_i a_i / d_{ij}^{\lambda}}$$

where: a_i is the attractivity of wetland i
(for simplicity we take the area of the wetland as a proxy for its attractivity; this is likely to be somewhat inaccurate, becuase some wetlands are more accessible by road, and some have more or fewer restrictions on use, but taking area as a proxy for attractivity is the best available first approximation)

d_{ij} is the distance from wetland i to community j

λ is the coefficient indicating how probability decreases with distance (for the sake of the following calculations, we assume it to be 2).

It is difficult to assess an appropriate value for the coefficient λ. The greater this coefficient, the stronger will be the association of each community with the nearest wetland area relative to its association with more distant wetland areas. This formulation does not take account of possible congestion at the current wetland areas in the region. If there is such congestion, then wetland users may be more inclined to divert their use from current wetland areas to areas further afield. In particular, wetland users from Moncton, Sackville and Amherst may be more attracted to a freshwater marsh on the Minudie Dykelands, relative to their attraction to existing wetland areas, than would be suggested by the above formulation. This might especially be the case if a freshwater marsh on the Minudie Dykelands were managed to offer some regionally unique amenities for some wetland uses.

With the above assumptions the probabilities, P_{ij}, are:

	Tintimarre	Missiguash	Chignecto	Minudie
Moncton, N.B.	0.344	0.510	0.130	0.011
Sackville, N.B.	0.624	0.279	0.095	0.002
Amherst, N.S.	0.262	0.170	0.564	0.001
Maccan, N.S.	0.078	0.330	0.573	0.019
River Hebert, N.S.	0.116	0.410	0.258	0.216
Springhill, N.S.	0.159	0.585	0.243	0.013
Southampton, N.S.	0.146	0.504	0.320	0.031
Minudie, N.S.	0.016	0.052	0.025	0.908

If we multiply each of these probabilities for the Minudie Marsh by the population of each corresponding community, and normalizing to obtain a total survey size of 100, we find that Moncton receives a large fraction of the assignments, becuase of its large population, and probably because we have not considered other wetlands opportunities for residents of Moncton, which may be available in other directions. Therefore, omitting Moncton from the communities to be surveyed, we obtain an allocation of survey respondents among communities as follows:

Community	No. of survey respondents
Sackville, N.B.	2
Amherst, N.S.	2
Maccan, N.S.	3
River Hebert & Joggins, N.S.	72
Springhill, N.S.	11
Southampton	1
Minudie	9
Total for all communities	100

4.3 Social/Option Value

The telephone survey of the general public was used to evaluate the social and option values of wetlands. These are the values that people attach to wetlands for the option that they might use them in the future, or for the use which society generally makes of them. Although it had initially been planned to survey 200 members of the general public, the initial target of 200 individuals was reduced to 100 (stratified as above) due to logistical constraints. This reduction did not seriously hinder the evaluation, however, since the high response rate (79%) provided a reasonably good sample size for analysis. Bardecki (1988) found low telephone response rates a serious problem in his study of the Greenock Swamp.

Of the 79 respondents to the general public survey, 57 (71.1%) were identified as non-users of wetlands and thus included in this part of the study. These individuals were queried on the following:

1) their recognition of the term "wetland";
2) their recognition of specific wetland values;

3) their opinions concerning the merits of conserving wetlands;
4) their willingness-to-pay for wetland conservation; and
5) their socio-economic characteristics.

Although most individuals were unable to explicitly identify wetland values apart from wildlife benefits, only 6 (10.5%) believed there were none. When presented with a list of benefits, there was quite high recognition of game/fish, recreation, and water quality values, as shown below.

Value of wetlands identified by respondents (N=57)

game and fish	43	(75.4%)
recreation	36	(63.2%)
improved water quality	26	(45.6%)
flood control	16	(28.1%)
endangered species protection	7	(12.3%)
ground water recharge	5	(8.8%)
wetlands have no value	6	(10.5%)

The sampling area has abundant wetlands (freshwater marshes, bogs, salt marshes, etc.), and it is not surprising that respondents were relatively knowledgeable of their existence and potential value. The recognition of wetland values is much greater than found by Bardecki (1988).

Eighty percent of respondents expressed the opinion that money should be used to conserve local wetlands, and most respondents indicated that either a nature organization (40%) or the provincial government (36%) would be most appropriate for having the responsibility to do this. The average willingness-to-pay among these respondents for local wetlands conservation was $28.00 (N=35), and ranged from $0.00 to $200.00. This value is approximatlely one-half that found by Bardecki (1988) and may reflect, among other things, (1) the relatively low income status of the population sample (70% indicated an annual income of less than $20,000), and (2) the absence of an apparent need to conserve wetlands in this already wetland-rich region.

4.4 Willingness-To-Pay of Users

The identification of users was divided into two broad groups: potential users of the hypothetical wetland and potential agriculture users. The most obvious, and in many repects, most difficult problem was that of prompting respondents to identify specific values with a non-existent wetland. Bearing this in mind, the following four user groups were identified and assessed:

1) members of a local naturalist club
(the Chignecto Naturalists Club)
2) members of a local sportsmen club
(the Cumberland County Fish and Game Association)
3) local farmers, and
4) general users.

The naturalist and sportsmen clubs were asked to complete the printed survey at regular meetings of their clubs on Thursday, 2 March, 1989 and Sunday, 5 March, 1989 respectively. A list of local dykeland farmers was provide by Ralph Murray (Nova Scotia Department of Agriculture). The general users - as

opposed to general "non-users" - were identified in the general public survey described in the previous section.

4.41 Naturalists

Analysis of the naturalists is limited by the small number of respondents (n=21). Sixty-one percent of the naturalists were indentified as current wetland users, and 12 (57.1%) of the individuals had visited the Minudie area for nature-related activities an average of twice during the past year. One-half of these individuals indicated that they would increase their current use of the Minudie area if part of it were developed as a fresh water wetland. Several individuals indicated that the increased number of waterfowl and marsh birds would be of interest to them, however, none indicated that such a wetland would be of particularly high value to them.

Seven of thirteen (53.8%) of the users felt that some effort should be made to develop part of the Minudie area into a fresh water marsh. The willingness-to-pay of the users for such a development was $22.20 (n=9) on average, with 4 of the 9 respondents indicating that a nature organization (Ducks Unlimited or Canadian Wildlife Service) would be the most appropriate organization to undertake such a development. Under the scenario that the wetland was developed and admission fees charged for use, the willingness-to-pay was only $.90 per person per visit.

Interestingly, several of these naturalists indicated strong opposition to the development of such a wetland on Minudie because of the value that they placed on the site's scenic and historical qualities. The remoteness and the vastness of the Minudie area associated with a long history of settlement and land use provide for them an impressive scenic landscape experience.

Naturalists identified as non-users of wetlands (n=10) were relatively knowledgeable of wetland values (in particular wildlife values), although opinions about developing part of the Minudie area as a wetland were mixed, with approximately equal numbers for, against, and unsure of such a scheme. Not surprisingly then, few individuals felt comfortable providing a willingness-to-pay estimate, and of those that did, the estimate was very low ($2.50 on average; n=2).

Overall, the willingness-to-pay for a wetland on Minudie by naturalists (both users and non-users) was quite low. This is surprising in view of the group's high income status (93.8% earn greater than $30,000 and 68.8% earn greater than $40,000,annually) and employment status (65% were currently employed). The main reason for such a low willingness-to-pay is most likely the existence of an abundance of wetlands in closer proximity to the residences of the respondents. A number of freshwater and other wetlands exist within short distances of Sackville and Amherst (less than 20 km), whereas Minudie is approximately 60 km from each.

4.42 Sportsmen

Since many of the sportsmen surveyed were probably waterfowl hunters (given the great opportunities for waterfowl hunting in the Chignecto area), it is not surprising that they indicated considerable knowledge about wetland values, particularly wildlife. However, only 7 of 30 (23.3%) had ever visited the Minudie area for the purpose of hunting, although these individuals

frequented the site fairly regularly (2-3 times per year, on average). One individual, for example, had visited Minudie 16 times in the past year. Few indicated alternative reasons for visiting the site besides hunting, although one person had also trapped there. Sixty percent (of 30) indicated that they would increase use of the area if it was developed into a fresh water wetland.

The 21 sportsmen identified as wetland users identified, without prompting, a wide variety of additional benefits associated with wetlands including birdwatching (n=3), fishing (n=2), trapping (n=1), family recreation (n=1), canoeing (n=1), wildlife preservation, water quality control (n=1), and flood control (n=1), although only 7 individuals placed high value on these additional benefits. Seventeen individuals (80.1%) did feel that efforts should be made to develop part of the Minudie as a fresh water wetland, and Ducks Unlimited, the Provincial government, and the Wildlife Federation were identified as the most appropriate organizations to administer the funds for such a development. The sportsmen indicated a willingness-to-pay of $15.50 (n=18) for this work. The eight respondents who supported the idea in principle, but were not willing to contribute financially, felt that taxes and hunting liscence fees should cover the costs. Under the scenario that the marsh be developed and user fees charged, sportsmen indicated an average willingness-to-pay of $5.30 (n=18) per person per day.

Of the sportsmen identified as non-users of wetlands (n=13), 8 indicated that wildlife values would accrue to a freshwater wetland at Minudie, while 7 and 4 individuals indicated that such a wetland would be beneficial for recreation and endangered species habitat respectively. Six of the non-users indicated support for the development of a fresh water marsh on Minudie, and an average willingness-to-pay of $13.00 (n=13) was determined.

The willingness-to-pay of the sportsmen was approximately equal to that of the naturalists, although small sample size limits this comparison. But regardless, these willingness-to-pay values were rather small. This was unexpected because it is generally assumed that hunters are willing to spend considerable funds to support high quality hunting experiences. As already discussed, the abundance of wetlands more proximate to residential areas is likely an important factor limiting individuals willingness-to-pay. Some of these wetlands are, in fact, excellent for waterfowl hunting. The sportsmen also represented a much lower income status group than the naturalists (74.1% earned less than $30,000 annually). An additional factor could be that hunters tend to frequent their favorite areas, and the value of such areas is often determined by both their long-term reputation for hunting success as well as their ability to provide a full recreation experience to the individual. It is difficult for a hunter to predict the potential of an area for fulfilling these goals.

4.43 General Public Users

Only 22 of the respondents from the general public survey were identified as wetland users. The most common reasons for utilizing a wetland were hunting (n=8), nature viewing (n=7), and sightseeing (n=6). In addition, a variety of other uses were identified by individuals including camping, driving, trapping, tree planting, skating, and "picking greens". The average number of visits last year by users in this group was 4.9 (n=22), although a considerable range was encountered (0-20).

Only 6 respondents identified a monetary figure that they would be willing to spend to permit their continued use of these wetlands. This value was the highest willingness-to-pay figure solicited from any single survey group ($62.50, on average). Twelve respondents were unable to estimate a willingness-to-pay, and only 4 (18.2%) indicated no willingness-to-pay for wetland use.

Almost all of the users were familiar with the Minudie area (86.4%), and most (77.3%) had visited Minudie at some period. The average visitation rate was 4.4 times in the past year (n=16). This average does not include one individual who resides there. The main reason for visiting the area was sightseeing (55.6% of visits), with hunting, bird watching, recreation, trapping, picking greens, and visiting included as other reasons.

One-half of the users (n=11) indicated a desire to see part of the area developed into fresh water marsh, with improved hunting and bird watching identified as important reasons for this increased attractiveness. All but one of these individuals felt that effort should be expended on such a development, and that either a nature organization or the Provincial government would be best suited to administer this effort. The average willingness-to-pay for such a development was $25.00 (n=5). Under the scenario that the area be managed and fees charged for use, the willingness-to-pay was on average $4.90 (n=8), and again the organizations identified as most appropriate for administering this were nature organizations and the Provincial government.

Although small sample size precludes an accurate comparison of values between groups, it is interesting to note that the general public users indicated the highest willingness-to-pay of all the wetland user groups. By virtue of their more apparent interest in wetlands conservation, the specific user groups (naturalists and sportsmen) would have been expected to indicate a higher willingness-to-pay. In addition, the general public users were of an income status nearly identical to the sportsmen (54.5% of the general users earned less than 20,000 annually) which is considerably lower than the naturalists (of whom none earned less than $20,000 annually).

The most important difference between the groups was in the survey methodology. The sportsmen and naturalists were asked to provide their highest willingness-to-pay in a survey questionnaire, whereas the general public were solicited by phone and provided with starting values. The average starting value was $40, whereas the average final willingness-to-pay was $25. It is likely that there was a "starting point bias" which raised the final willingness-to-pay bids higher than they might otherwise have been.

4.44 Agriculturalists

The farmers surveyed in this study were selected on the basis of their use of dyked lands for agricultural purposes. It is not surprising then that 28 of 29 respondents (96.6%) were familiar with the term wetland. In fact, this same number indicated their land currently included or used to contain wetlands. Eighteen (62.1%) were identified as users of wetlands. Knowledge of wetland values was mixed, with approximately one-half (44.8%) considering wetlands to be beneficial. Interestingly, this was the only group with respondents that considered wetlands to be harmful (17.2%). No farmers had ever leased their wetlands to hunters - a practice not uncommon in some areas

in the Maritimes.

Twenty-five (of 28) farmers (89.3%) were familiar with the Minudie dyked lands, and 18 (64.3%) had actually visisted the site. The reasons for visiting included pasturing cattle (n=8), viewing (n=7), farming (n=3), and goods delivery (n=1). An average visitation rate of 1.4 times over the past five years (n=28) was recorded.

When presented with the scenario of developing a freshwater wetland on part of the Minudie, the general feelings were that benefits would either be lost (n=13; 46.4%) or that there would be no direct affect (positive or negative) on the individual respondent ($46.4%), but that it seemed unfortunate to lose good agricultural lands even though wildlife would benefit. Only two indivdiduals indicated that such a development would have net benefits. There were no willingness-to-pay estimates made by these two respondents, although one individual indicated that some effort be expended to develop part of the land as freshwater marsh.

Twelve farmers were queried as to the loss of benefits from resulting from such a scheme. Understandably, 10 (83.3%) felt that the greatest loss would be agricultural lands. Three respondents indicated that depredation of grain crops by waterfowl and muskrat would be a serious negative impact. One person believed that such a development would attract destructive users such as all terrain vehicle (ATV) drivers and partiers. All 12 of the respondents considered losses to be substantial, and, not surprisingly, all felt that effort should be expended to maintain the Minudie dyked lands as usable agricultural land. The organizations considered most appropriate for maintaining this land as such were a farmers' cooperative (n=7), the Provincial Government (n=6), a community management board (n=3), a private developer (n=3), and the Maritime Resources Management Service (MRMS) (n=1). It should be recalled here that part of the Minudie dykelands has been provided as community pasture. This likely explains the high response in favour of cooperative or community management of the area.

Seven farmers indicated that they might utilize the Minudie area for pasturing cattle and one for hay growing. Four farmers indicated that Minudie was too distant to make its use worthwhile. The willingness-to-pay for use of the area was approximately $50 per head of cattle per season (n=4), which reflects approximately the current rate for pasturing in the area. Five individuals could not estimate a willingness-to-pay without a clear idea of the market conditions for their products.

All except one of the 29 surveyed farmers were male. Most were middle to upper-middle age and of relatively high income status (only 18.2% earned less than $20,000 per annum, and 26.9% earned greater than $40,000).

The following table summarizes three critical willingness-to-pay (WTP) values determined by this study: (1) the percentage favouring effort for development of a wetland at Minudie; (2) the average willingness-to-pay for development of a wetland at Minudie; and (3) the willingness-to-pay for the daily admission to a developed wetland at Minudie. Numbers in parentheses indicate sample sizes.

	favour wetland (%)	WTP develop ($)	WTP admission ($)
Wetland Users			
naturalists	53.8 (21)	22.2 (9)	0.9 (9)
sportsmen	81.0 (21)	15.5 (18)	5.3 (18)
general public	50.0 (22)	25.0 (11)	4.9 (11)
		37.5 (10)*	
agriculturalists	11.1 (18)	-	-
Wetland Non-users			
naturalists	33.3 (10)	2.5 (2)	-
sportsmen	46.2 (13)	13.0 (13)	-
general public	80.0 (55)**	28.0 (35)***	-

* willingness-to-pay for continuing use of wetlands in general
** percentage supporting conservation of wetlands in general
*** willingness-to-pay for conservation of wetlands in general

4.5 Conclusions from Willingness-to-Pay Method

In conclusion, application of the willingness-to-pay method was severely hampered by starting point biases. Furthermore, it was difficult in practice to distinguish which of at least four possible evaluations respondents were implicitly making in their answers: (1) the value they attached to existing wetlands in the region, (2) their value for expanding the area of wetlands in the region, (3) their value for establishing a wetland on the Minudie dykelands in particular; (4) their value for establishing a wetland on the Minudie dykelands relative to establishing a wetland on other potential sites. To provide more useful results, the WTP surveys would have to distinguish among these different evaluations more carefully, and even then difficulties of interpretation might arise. If it is possible to design a survey which makes these distinctions and unambiguously specifies the hypothetical wetland in ways that respondents can understand, such a survey would probably be prohibitively lengthy and expensive to administer.

Rather than using a survey, another approach which might provide a more meaningful measure of willingness-to-pay, at least in this case, would be to bring representatives of users and non-users together in some kind of workshop or town meeting to define the alternatives and options. Scientists should also participate to explain the ecological implications of each option. After the participants had all their questions answered and gained a clearer understanding through this process, questions about willingness-to-pay might provide results of greater meaning, reliability and usefulness.

CHAPTER 5
APPLICATION OF THE OPPORTUNITY COST APPROACH

5.1 The Opportunity Cost Method

The opportunity cost approach consists in evaluating the benefits that are foregone in making one choice over the best alternative choice. In the present case, the opportunity cost of maintaining the Minudie dykelands in agricultural use is the net benefits of the wetland alternative which is forgone. The opportunity cost of the wetland alternative is the net benefits of the agricultural use which would be forgone. In evaluating the net benefits of the alternative uses, consideration should be given to the possibilities of providing these benefits at other sites or by other means, each with their own associated costs. If, for example, the same benefits can be provided at another site at a somewhat greater cost (but still less than the benefits), then the net benefits that would be forgone by displacing the alternative use to the other site is just the difference in costs at the other site over the costs of producing the same benefits at the original site.

For agriculture use, the alternative site under consideration may be another area of dykeland, if available, or otherwise an area of upland. For freshwater marsh, the specification of an alternative site (or means) is more difficult. There is unlikely to be a single site of comparable size available on upland for development as wetland, which could fulfill all of the same functions. As already noted, maintenance of wetland for waterfowl habitat on the organic soils in upland areas encounters severe problems with mats of vegetation which reduce the quantity and quality of habitat. There are also no apparent alternative technical means to fulfill the functions, especially wildlife functions, which would be performed by a freshwater marsh on the Minudie dykelands.

Consequently, application of the opportunity cost method in this case comes down to evaluating (either directly or in terms of opportunity cost) the net benefits gained from the additional functions which would be performed by converting an area of the Minudie dykelands to freshwater marsh, and seeing if this exceeds the net benefits which would be lost (if any) in relocating the agricultural activities which are currently conducted on the Minudie dykelands to an alternative area. If there is unused dykeland which would serve agricultural uses equally well as the Minudie dykelands, then there would be no loss in relocating agricultural activities on the Minudie dykelands to these unused dykelands. If there is no unused dykeland, but there is a sufficient area of suitable unused upland, then the loss in relocating agricultural activities on the Minudie dykelands to these unused uplands would be the additional costs (if any) which would be involved in obtaining the same agricultural benefits on the upland as were obtained on the dykeland. Therefore, consideration was given in this study to the costs and benefits of agricultural production on both dykelands and uplands.

The results of evaluation of agricultural and wetland uses on an area like the Minudie dykeland and on upland in the same vicinity are presented in Tables 5.1 (Tidal land) and 5.2 (Upland) respectively. Documentation of these tables is provided in Appendix 7.

TABLE 5.1
ANNUAL COSTS AND BENEFITS OF EACH LAND USE ($/HA-YEAR)

TIDAL LAND

LAND USES / COSTS AND BENEFITS	cost of maintaining dykes, impoundments, etc. (1)	cost of maintaining access and drainage (2)	cost of fertilizer, nutrients, soil amendments, etc. (3)	cost of pest control (4)	labour and other production and maintenance costs (5)	external costs (6)	TOTAL COST (7)=Σ(1)-(6)	commercial value of product(s) (8)	wildlife conservation benefits (9)	other consumptive use benefits (10)	non-consumptive use benefits (11)	other benefits not included above (specify) (12)	TOTAL BENEFITS (13)	NET BENEFITS (14)=(13)-(7)
pasture	7(a)	4(b)	0(c)	0(c)	0(d)	/	11	172(e)	+	-	+	-	172+/-	161+/-
hay production	7(a)	4(b)	93(f)	7(g)	513(h)	/	624	607(i)	++	-	+	-	607+	-17+
cereal/legume production	7(a)	4(b)	92(j)	67(k)	616(l)	/	786	1116(m)	++	+	-	-	1116+	330+
sod production	7(a)	247(n)	741(o)	494(p)	1420(q)	/	2909	5928(r)	-	--	--	--	5928-	3019-
freshwater marsh	12(s)	21(t)	0	0	0(u)	/	33	92(v)	++++	105(w)	++++	++++	197+	164+
saltmarsh	0	0	0	0	0	/	0	++	++++	++++	++	++++	+	+

Note: letters in parentheses, +, - refer to notes Appendix 7.

TABLE 5.2
ANNUAL COSTS AND BENEFITS OF EACH LAND USE ($/HA-YEAR)

UPLAND

COSTS AND BENEFITS	pasture	hay production	cereal/legume production	sod production	freshwater marsh	saltmarsh
cost of maintaining dykes, impoundments, etc. (1)					8.6(m)	
cost of maintaining access and drainage (2)	0(a)	0(a)	0(a)		0	
cost of fertilizer, nutrients, soil amendments, etc. (3)	0(b)	232(e)	154(i)		0(n)	
cost of pest control (4)	0(c)	7(f)	67(j)		0(o)	
labour and other production and maintenance costs (5)	0(b)	513(g)	616(k)		/	
external costs (6)	/	/	/		8.6	
TOTAL COST (7)=Σ(1)-(6)	0	752	837		92(p)	
commercial value of product(s) (8)	172(d)	460(h)	1116(l)		+++	
wildlife conservation benefits (9)	-	-	+		105(q)	
other consumptive use benefits (10)	-	-	-		+++	
non-consumptive use benefits (11)	+	+	-		++++	
other benefits not included above (specify) (12)	+	+	-		197+	
TOTAL BENEFITS (13)	172+/-	460+/-	1116-		188+	
NET BENEFITS (14)=(13)-(7)	172+/-	-292	279-			

Note: letters in parentheses, +, - refer to notes Appendix 7.

5.2 Preliminary Evaluation of Wetland Wildlife Benefits

The value given for commercial value of products in Table 5.1 is the value of the expected muskrat harvest. The value given under other consumptive use benefits reflects the maximum cost which Ducks Unlimited Canada is willing to pay in the Maritime provinces for productive capacity of one duck per year (personal communication, John Wile, Ducks Unlimited Canada). The amount shown is this amount, $21 per duck, multiplied by the expected productivity of 5 ducks per hectare-year, which yields $105 per hectare-year.

Another estimate of wetland value is suggested by the commitment expressed in the North American Waterfowl Management Plan to protect 10,000 additional acres (4,000 hectares) of black duck migration and wintering habitat in the Atlantic Region, at an estimated cost of $5 million (Environment Canada, Canadian Wildlife Service, 1986). This suggests an average value of such habitat of at least $1,250 per hectare. To be considered worthwhile, such an investment would have to produce net benefits of at least $125 per hectare-year, assuming a discount rate of 10%.

Another estimate of value per duck is suggested by the survey results of Jacquemot et al. (1986), which found net economic values of waterfowl hunting to residents of Nova Scotia of $3.2 million in 1981. This corresponds to an estimated retrieved kill of 113,601 ducks in Nova Scotia in the same year (Metras and Wendt, 1986). Together, these figures suggest a value of $28.17 per harvested duck. Jacquemot et al. (1986) also give a value to Nova Scotians of $10.2 million for non-consumptive wildlife-related recreational activites for all wildlife in 1981. While it is difficult to distinguish what fraction of this non-consumptive value can be attributed to waterfowl or wetlands-associated wildlife, it is likely to be an amount at least equal to the consumptive value. This gives a total value per duck almost three times greater than the maximum amounts paid by Ducks unlimited Canada and governments. Therefore, the value of Nova Scotia wetlands per hectare-year for waterfowl (if the value of a waterfowl produced is its value harvested) and non-consumptive use of wildlife could also be at least three times the maximum amounts paid by Ducks Unlimited Canada and governments, or over $300 per hectare-year. It is interesting to note also that the estimated total wildlife expenditures by residents of Nova Scotia in 1981 was $167.2 million or about five times the $33.3 million net economic value of wildlife-related recreational activities to residents of Nova Scotia in 1981 (Jacquemot et al., 1986). If this proportionality holds for wildlife activities which depend on wetlands, then the average contribution of wildlife-related recreational expenditures to the Nova Scotian economy would be at least $1,500 per hectare-year for prime wetland.

As discussed below, Gupta and Foster (1975) estimated the annual net value of wildlife benefits from the most productive wetlands in Massachusetts at $70 per acre-year in 1975 U.S. dollars (based on the willingness-to-pay for wetland acquisition of the Massachusetts Division of Fisheries and Game). This converts to a value of approximately $530 per hectare-year in 1988 Canadian dollars. Government agencies have not provided information on recent purchase prices for wetlands in the Chignecto area, but these prices, and the value of wetlands, are probably lower than in Massachusetts, because the Chignecto area has a much lower population density able to derive benefits from the wetlands than has Massachusetts.

On the basis of the above considerations, it appears that the economic value of prime wetlands in the Chignecto area for wildlife production is of the order of $300 per hectare-year. Capitalized at a real discount rate of 10% (as per Treasury Board Guidelines), this represents a present value of $3,000 per hectare. (In decisions involving irreversible alienations of wetlands, such evaluations should be qualified in terms of additional considerations such as quasi-option value, appreciation of value over time, intergenerational equity, etc.)

In order to evaluate a freshwater marsh on the Minudie dykelands more systematically against the full range potential wetland benefits, two methodologies were tentatively applied: the Wetland Evaluation Technique (WET) developed by Adamus et al. (1987), and the economic criteria for freshwater wetland policy in Massachusetts (Gupta and Foster, 1975). Although the WET embodies more current understanding of wetland functions and benefits, it is only qualitative, while the method of Gupta and Foster attempts to provide quantitative evaluations.

5.3 Wetland Evaluation Technique (WET)

The Wetland Evaluation Technique (WET) (Adamus et al., 1987) evaluates the following 14 wetland functions:

1) Groundwater recharge
2) Groundwater discharge
3) Floodflow alteration
4) Sediment stabilization
5) Sediment/toxicant retention
6) Nutrient removal/transformation
7) Production export
8) Wildlife diversity/abundance
9) Wildlife diversity/abundance breeding
10) Wildlife diversity/abundance migrating
11) Wildlife diversity/abundance wintering
12) Aquatic diversity/abundance
13) Uniqueness/heritage, and
14) Recreation.

These functions are evaluated in terms of three values:

1) opportunity: whether the wetland has the chance to perform a given function;

2) effectiveness: the probability of a wetland being productive in maximizing the opportunity; and

3) significance: the degree to which the function is valued by society, in part as reflected by its scarcity.

The WET method attempts to determine the relative value - measured in terms of low, medium, or high - for each of the fourteen functions, based on the probability that that function exists or not. It does not assess the magnitude of that function. The results are presented in Table 5.3, and discussed below in brief. Documentation, which indicates in greater detail how WET was applied in this case, is attached as Appendix 8.

In applying the Wetland Evaluation Technique to the hypothetical "Minudie Marsh", two major assumptions were made. First, it was assumed that the proposed marsh would include a single fresh water wetland confined within dykes on all but the upslope side and managed with controlled water level structures.

	Social Significance	Effectiveness	Opportunity
1) Groundwater recharge	M	L	*
2) Groundwater discharge	M	H	*
3) Floodflow alteration	M	H	H
4) Sediment stabilization	M	M	*
5) Sediment/toxicant retention	M	H	L
6) Nutrient removal/transformation	M	H	L
7) Production export	*	M	*
8) Wildlife diversity/abundance	H	*	*
9) Wildlife d/a breeding	*	H	*
10) Wildlife d/a migrating	*	H	*
11) Wildlife d/a wintering	*	H	*
12) Aquatic diversity/abundance	M	M	*
13) Uniqueness/heritage	H	*	*
14) Recreation	H	*	*

Table 5.3 - Summary of WET evaluation results for the hypothetical Minudie Marsh
(Note: "H" = High, "M" = Moderate, "L" = Low, "U" = Uncertain, and "*"'s identify conditions where functions and values are not evaluated.)

Second, evaluation measures are derived from predictions based on a hypothetical marsh under the assumed management scenario in which maximum waterfowl productivity is the primary objective. This implies, for example, the maintenance of optimal vegetation dispersion and water levels for waterfowl breeding. Fortunately, numerous similar marshes, about which considerable biophysical information has been collected, are found in the Region, and can be utilized for extrapolation with reasonable confidence as to their applicability to the hypothetical Minudie Marsh. Detailed biophysical and other data specific to the Minudie site were utilized (derived from a brief site visit, topographic and ortho-photo maps, and soil maps) and taken into consideration when drawing comparisons from other marshes.

1) Groundwater recharge

A wetland is considered important for groundwater recharge when it provides a net input of groundwater and where that input typically exceeds the rate of recharge from terrestrial areas. Effectiveness of the Minudie Marsh for this is rated low because the marine deposited silt clay loam sediments which underlay the marsh permit very low infiltration rates. The Minudie Marsh provides only moderate significance for groundwater recharge due to the very limited demand for groundwater in the local area.

2) Groundwater discharge

The potential effectiveness for the Minudie Marsh to contribute to groundwater discharge is rated high by WET because the marsh represents a significant portion of the overall watershed size (approximately 40%), remains permanently flooded all year with little change in the area covered by water, and the soil permeability of the watershed decreases in a downslope direction towards the Marsh. The Minudie Marsh provides only moderate significance for groundwater discharge due to the very limited demand for groundwater in the local area.

3) Floodflow alteration

Opportunity for floodflow alteration is rated high because the watershed soils are essentially impermeable throughout and there exist no other wetlands upslope of the Minudie Marsh. Effectiveness is based on "the probability that storage or loss (of water) will occur or lag time will be measurable increased" (Adamus et al., 1987). The Minudie marsh is rated highly effective for floodflow alteration because of the regulated water level, the higher net inflow to outflow, and the relatively large size of the Marsh. Parts of the Minudie area have been used for the production of cattle, although hay has intermittently been grown there in the past. Flooding of the local area could damage a hay crop or reduce livestock production by reducing the grazing area. However, threat of serious economic or other damage is limited by the absence of dwellings and other structures in the local area, and therefore, the social significance score is only moderate.

4) Sediment stabilization

Both effectiveness and significance are rated moderate by WET because there are no significant sediment inputs to the Minudie marsh, although the marsh is relatively exposed to winds and therefore could suffer some erosion.

5) Sediment/toxicant retention

The opportunity and significance of the Minudie marsh for sediment/toxicant retention is limited due to the absence of potential inputs and the isolation of the Marsh from populated areas. Opportunity is rated low also because the watershed is forested. The Minudie Marsh is impounded, and characterized by extensive, persistent vegetation, low flow, and constricted outlet for flow. All of these factors contribute to the high rating Minudie receives for sediment/toxicant retention.

6) Nutrient removal/transformation

The same significance and opportunity evaluations are predicted as for sediment/toxicant retention, and for the same reasons. Effectiveness of the Minudie Marsh is rated high for the same reasons as indicated for sediment/toxicant retention, with fine mineral soils identified by WET as an additional contribution to nutrient removal/transformation potential.

7) Production export

Managing wetlands for waterfowl productivity requires, in approximate terms, maximizing productivity levels of the marsh, in general. However, the small size of the watershed and the intermittent outlet of water would limit export

of this production from the Marsh. The effectiveness score is thus only moderate. Neither the social significance nor the opportunity for production export are evaluated by WET.

8-11) Wildlife diversity/abundance

According to WET, wildlife diversity/abundance scores high all around (general, breeding migration, and wintering) for the Minudie Marsh. The Marsh would be developed and managed specifically for the enhancement of wildlife (waterfowl, in particular) and thus scores highly for significance and effectiveness. In addition, the location of the Minudie Marsh is important becuase it is located on a major migratory flyway (the Atlantic Flyway), and adjacent to numerous habitats (saltmarsh, mudflats, open water, and forest) which further enhance its effectiveness to support wildlife.

12) Aquatic diversity/abundance

Both significance and effectiveness ratings by WET are moderate for aquatic diversity/abundance. On one hand, the Minudie Marsh would be permanently flooded and support relatively productive and diverse aquatic vegetation. On the other, the reason that Minudie only receives a moderate as opposed to high rating is because the Marsh's aquatic productivity/abundance potential is limited by the absence of a permanent inlet and permanent outlet, falling summer water levels, warm summer water temperatures, and winter freezing.

13) Uniqueness/heritage

The Minudie Marsh scores high for significance using WET because of the considerable financial investments required to develop and manage the Minudie Marsh, as well as the identified objective of these investments, i.e. deliberate management for wildlife conservation. Apparently, WET associates significance with investment in an area, without regard to whether that investment yields any net benefits, or indeed any benefits at all.

14) Recreation

The high score for recreation significance is indicative of the fact that the recreational activities which the Minudie Marsh support (e.g. hunting, bird watching) are locally deficient (locally being defined in terms of the Minudie Point area). It is worth noting, however, that this is not the case when considered in a regional context (the Chignecto area). This, again, appears to be a quirk of the WET system, that the wetland can receive a high score for recreational significance in the local area, even though the population of the local area is only a few people at most.

The Wetland Evaluation Technique is a coarse tool based in most cases on the application of very general decision-rule criteria. As a result, the outcomes (results) may appear somewhat misleading to one unfamiliar with the method. Adamus et al. (1987) emphasize that the method should not take the place of professional opinion when such opinion is available. It makes little sense, for example to focus on the wildlife ratings of WET as they are sure to be less informative than the opinions expressed by a number of wildlife biologists familiar with the Chignecto wetlands.

In general, WET is useful for identifying potential "red flags": values

deserving of special attention. Because it rates according to general qualitative criteria, WET is essentially a reference by which specific values can be more clearly identified and subsequently quantified using other sources of information. In this case, however, WET tends to confirm our preliminary evaluation that only wildlife and recreational values should be considered important in the case of the hypothetical Minudie wetland.

5.4 Massachusetts Wetland Policy Economic Criteria

The economic criteria developed by Gupta and Foster (1975) for wetlands policy in Massachusetts considers four categories of benefits: 1) wildlife values, 2) visual-cultural values, 3) water supply benefits and 4) flood control benefits.

1) Wildlife Values

As mentioned above, Gupta and Foster measured wildlife benefits in terms of the prices which the Massachusetts Division of Fisheries and Game was willing to pay for wetland acquisitions, yielding "a value of $1200 [in 1975 U.S. dollars] per acre .. as the capitalized value of wildlife benefits with highest quality wildlife characteristics". Based a discount rate of 5.375%, this sugggested an expected value of $70 per acre-year [in 1975 U.S. dollars] of wildlife benefits. To evaluate wetland of less than highest quality, Gupta and Foster used the habitat suitability index developed by Francis Golet (Golet, 1978). Wetland with a Golet score of 100 or greater was considered to have the full $70 per acre-year of value, while the value of wetland with Golet scores of less than 100 was prorated accordingly, e.g. a wetland with a Golet score of 60 would be considered to have wildlife benefits of $42 per acre-year.

Although the present study has not been provided with a full data set necessary for this method of evaluation, some indication of wildlife values associated with wetlands in the Maritimes is suggested by the proposed budget of the Eastern Habitat Joint Venture of $10 million to purchase 10,000 hectares of habitat over the next 15 years (personal communication, Al Smith, Canadian Wildlife Service). This suggests an evaluation of average habitat of $1,000 per hectare. Assuming a discount rate of 10%, this corresponds to an expected benefit flow of $100 per hectare-year of wildlife benefits. Because this figure is based on data for the average amount that wildlife agencies expect to pay, rather than the maximum amount that they are willing to pay, it underestimates actual value. In terms of order of magnitude, however, this result tends to confirm the estimates given earlier in this chapter.

2) Visual-Cultural Values

The method of Gupta and Foster for measuring visual-cultural values was similar to their method for measuring wildlife values. A willingness-to-pay of $5,000 per acre (in 1975 U.S. dollars) was established for wetlands which were considered to yield high productivity of visual-cultural benefits. This value could then be prorated for a particular wetland according to a system for scoring visual-cultural benefits developed by Richard Smardon (Smardon, 1983), similar to Golet's system for scoring wildlife benefits. This visual-cultural scoring system was based on variables such as "land form contrast, wetland type diversity, wetland size, water body size, location of

wetland, and visual and noise pollution".

In the absence of the necessary data set, and with no known examples of wetlands in the Maritimes which have been acquired mainly for their visual-cultural benefits, it has not been possible to apply this evaluation method to the hypothetical Minudie Marsh. It may be instructive to apply the Smardon scoring system to the Minudie Marsh under the configuration suggested for it, however.

3) Water Supply Benefits

Gupta and Foster measured the value of water supply benefits by taking the difference between the costs of water from a central, state-wide water utility and the costs of water from local, wetland-fed sources. Since the hypothetical Minudie Marsh would have practically no effect on any water supply, neither this method nor these benefits apply in this case.

4) Flood Control Benefits

Gupta and Foster evaluated the flood control benefits of wetlands by reference to a U.S. Army Corps of Engineers study which found that the preservation of 8,422 acres of wetland in part of the Charles Basin would yield flood control benefits (avoided losses) of an average of $647,000 per year. This suggested flood control benefits for areas with "high" flood control potential of $80 per acre-year. As with the evaluation of the other categories of benefits, wetlands with less than "high" potential for this function would be valued proportionately lower.

Once again, because the hypothetical Minudie Marsh would have practically no implications for flood control, these benefits do not apply in this case.

In the application of the method of Gupta and Foster to the hypothetical Minudie Marsh, the only category of benefits to which substantial, quantitative benefits can be assigned is the category of wildlife benefits. What is particularly interesting to note for this study, however, is that wildlife benefits yield the lowest maximum potential benefits of the four benefit categories in the Gupta and Foster method applied to Massachusetts wetlands; the maximum potential benefit for wildlife was $70 per acre-year, while those for visual-cultural, water supply and flood control benefits were $270 per acre-year, $2,800 per acre-year and $80 per acre-year respectively. Similarly, if the hypothetical Minudie wetland is found to have a low value, this may be because it would only provide benefits in the wildlife category, and almost none in the other categories.

5.5 Conclusions from Opportunity Cost Method

The rough calculations of net benefit for each use of tidal land show small quantified net benefits of the order of tens, or, at most, hundreds of dollars per hectare-year, as well as additional unquantified benefits, from freshwater marsh. Hay production for sale yields almost no net benefits. Pasture and cereal/legume production yield net benefits of the same order of magnitude as the quantified net benefits of freshwater marsh, but have lower unquantified benefits. Sod production yields high quantified net benefits, but rates lowest in terms of the unquantified benefits.

When we evaluate the potential land uses on the Minudie dykelands from the perspective of opportunity cost, however, we consider alternative means or alternative sites for achieving the benefits of each land use. In the case of freshwater marsh, wildlife biologists have suggested that there is no other site of comparable area which can be managed to yield the same kinds of benefits as the hypothetical Minudie Marsh. If this is the case, then the benefit forgone by not having a freshwater marsh on the Minudie dykelands is the full net benefit indicated above.

On the other hand, any use of the Minudie dykeland for pasture, hay or cereal/legume production could potentially be relocated to unused dykeland or unused upland elsewhere. There was an estimated 14,044 hectares of abandoned farmland in the Chignecto area in 1981 (down from 17,232 hectares in 1961), of which an estimated 4,988 hectares was dykeland (down from 6,761 hectares in 1961) (Arbour and Wilson, 1988). Therefore, it appears that such relocation should be feasible, although there may be some initial costs in bringing some of this abandoned farmland back into production. Then, the benefits foregone by relocating agricultural activity on the Minudie dykelands to other dykelands would be only these small costs. The benefits forgone by relocating this activity to uplands would only be sum of these small costs and the difference between the net benefits of this activity on dykeland and the net benefits on upland. In either case, the net benefits lost would be small, and they would probably be smaller than the quantified benefits foregone by not having a freshwater marsh on the Minudie dykelands (although the range of uncertainty in the cost and benefit estimates leave some doubt in the matter). There is a caveat to this argument in that relocation of activities to abandoned farmland may result in additional problems of land fragmentation, which have inhibited efficient agriculture in the Chignecto area in the past (Jackson and Maxwell, 1971).

In theory, there would also be a problem about relocating sod production from dykeland to upland, in that sod production is not sustainable on upland, because of the removal of topsoil required with each harvest, whereas it is theoretically sustainable on dykeland, where topsoil can be replaced by "tiding", i.e. maintaining a small opening in a dyke for several years to allow the dykeland to be flooded, so that a new layer of sediment could be deposited. As already indicated, however, the Minudie dykelands are not likely to be a preferred site for sod production.

In addition to the uncertainty over the cost and benefit estimates, a major reason for the residual doubt about the comparative economic benefits of a freshwater wetland on the Minudie dykelands is that, although such a wetland would be very beneficial in terms of wildlife productivity and diversity, it would yield little in terms of the other social benefits which are associated with freshwater wetlands. This suggests that wildlife conservationists would do well to consider other social values, in addition to wildlife values, in selecting wetland sites as candidates for conservation, if they wish to make a strong case in terms of overall benefits.

Overall, we conclude that the Gupta and Foster method is a very efficient way of estimating the relative values of wetlands within a region, if it is properly calibrated for that region. Furthermore, the concept of opportunity cost - the value foregone by allocating resources to one use rather than another - is very relevant in this case; this will be taken up in Chapter 7.

CHAPTER 6
APPLICATION OF CUMULATIVE IMPACT METHOD

Application of the cumulative impact method involves an evaluation of a proposed alteration to the environment against a series of specific standards reflecting the range of applicable societal goals and objectives. This approach has been applied to existing wetlands when evaluating the potential benefits and impacts from an alienation of the wetland. However, in the case of the Minudie dykelands, the existing use of the area is agricultural production. Therefore, what is being proposed is that a portion of the existing pasture land be flooded to create freshwater marshland.

The aim of the cumulative impact method is to establish a set of criteria, both quantitative and qualitative which can be identified from the existing legislated and stated public policy goals and objectives. The objective is to develop a set of practical indicators of values derived from the various wetland functions. These indicators rely on already established criteria, particularly those that are legislated or established in some acceptable form as objectives for communities or regions. Criteria were drawn from some of the policy-related references listed in the Bibliography.

6.1 Cumulative Assessment Approach Matrix

The following headings, and discussion under each, correspond to the Cumulative Assessment Approach Matrix (Bond, 1988).

Economic viability

The fee for grazing cattle on community pastures operated by the Nova Scotia Department of Agriculture and Marketing is 32 cents per day. Based on this fee, it has been estimated that the Department could receive $39.45 per hectare-year for the services of the community pasture on the Minudie dykelands. Furthermore, the value of this service to farmers in terms of conversion from grass to beef is estimated to be approximately $172 per hectare-year. The costs of maintaining dykes, drainage and access on the Minudie dykelands is estimated to be only $11 per hectare year. From these figures, it appears that the community pasture is economically viable.

However, the picture is somewhat more complicated in that agriculture receives a number of subsidies from both the federal and provincial governments. It is not clear whether or not, in the absence of these subsidies, there would be farmers willing to pay more than the costs of providing the community pasture service on the Minudie dykelands. These subsidies make the prices of agricultural products lower than they would otherwise be. With lower prices, demand for these products is greater, and more resources (including land) are put into agricultural production than would be the case with no subsidies. In some cases, however, marketing board arrangements restrict the quantities of products which farmers can sell.

The major programs through which the federal government provides direct agricultural subsidies, for which Maritime farmers are eligible, are the Agricultural Stabilization Program, crop insurance and the fuel tax rebate. Federal and provincial governments also provide subsidized financial and credit programs for farmers. In addition, the federal government provides

indirect subsidies through storage, marketing and freight assistance.

The Nova Scotia and New Brunswick governments subsidize "land improvement", including clearing and drainage, as well as limestone and fertilizer use by farmers. There are also programs to reduce property taxes on farms. In addition to all of the above, food products are exempt from federal and provincial sales taxes. Although the tax exemptions are not strictly "subsidies", they have the same effects as subsidies in that they reduce effective prices to consumers and thus increase demand for food products relative to demand for taxable, non-food products.

Site Alternatives

There are a number of alternative wetland sites in the immediate region (100 kilometre radius). Chignecto National Wildlife Area, Missaguash Marsh, Amherst Marsh, Eddy Marsh, Maccan Marsh, Tintamarre National Wildlife Area, Shepody National Wildlife Area, Chignecto Game Sanctuary as well as a number of small, privately-owned wetlands, managed by Ducks Unlimited Canada.

As noted in the conclusions from the opportunity cost method (section 5.5), there are also other viable sites within the Chignecto area for the present agricultural activity on the Minudie dykelands. Furthermore, not all of the Class 2 Agricultural land in Nova Scotia is being used. In addition the land that is in production could be used more intensely. Part of the reason for the present situation is that people are unwilling to relocate to new areas to start their own farm. As a result, there is a land fragmentation problem as adjacent land is cleared for cultivation despite there being better land in another areas.

Developing upland areas for agricultural production is more expensive than utilizing dykeland but there are advantages in being able to get on to the land earlier in the Spring. While there are not the initial costs of dyking involved with upland farming, costs for developing uplands for agricultural purposes includes the initial costs of clearing and levelling, as well as the costs of installing tile drains if necessary, and stoning. Upland soils tend to require more fertilizer and upkeep as nutrient levels deplete and soils become susceptible to compaction.

Water Quality

Agricultural use of the Minudie dykelands adjacent to the proposed wetland will have very little effect on the water quality of the area. This is partly because of the few inputs needed for agricultural production in the area. Given the present use of the area for hay and pasture, the use of fertilizers and other chemicals has been negligible in terms of water quality impacts. If agricultural practices were to change, however, and more chemicals were introduced (e.g. for sod production), there may be water quality problems.

Toxics

Toxic inputs from existing agricultural practices are likely to be very low, although there are no specific data available on actual use of chemicals on the Minudie Dykelands. In any case, there are no downstream users of the groundwater who would be significantly affected.

A problem related to toxics is pests. In this regard, the Minudie Dykelands are notorious for large populations of mosquitoes. The low permeability of the soil allows rain water to remain in shallow pools on the surface for extended periods. These shallow pools provide ideal breeding areas for mosquitoes. Given the northeasterly direction of the prevailing winds, there is potential for some of these mosquitoes to be blown over to population centres at Amherst and Sackville. It needs to be determined whether the establishment of an area of freshwater marsh on the Minudie Dykelands would reduce or exacerbate the mosquito problem.

Water Quantity

Building additional dykes and flooding part of the area for freshwater wetlands is unlikely to have impacts on the water quantity of the area.

Wildlife Availability

The amount and type of habitat available to wildlife is limited by the present agricultural practices. Some agricultural practices could benefit wildlife habitat development significantly such as grain crops for forage and tall grass for nesting. Flooding part of the area to create freshwater marsh habitat would increase the habitat quantity and diversity available to waterfowl in the area.

There is currently concern to increase populations of waterfowl, especially black duck, which have been declining in recent years. The North American Waterfowl Management Plan, endorsed by the Canadian and U.S. Governments (Environment Canada, 1986) calls for the protection of an additional 10,000 acres (4,000 hectares) of black duck habitat on the east coast of Canada during the fifteen year period 1986 to 2000. The Eastern Habitat Joint Venture is even more ambitious, with a budget of $30 million over the next fifteen years, of which $10 million is budgeted to create and protect 10,000 hectares of new habitat, and $18 million is budgeted to enhance 20,000 hectares acres of existing habitat (personal communication, Al Smith, Canadian Wildlife Service).

There is also support for creation and expansion of waterfowl habitat at the local level. Ducks Unlimited Canada raised over $96,000 last year from about 1500 contributors through its local committees within the study area (Amherst, Sackville and Moncton) (personal communication, John Wile, Ducks Unlimited Canada). As one of the items of its five year action plan for Amherst and area, the Cumberland Futures Committee will "cooperate with [the Nova Scotia] Dept. of Lands and Forests, Fish and Wildlife Division and Ducks Unlimited to develop wildfowl marshes as major tourist attraction[s]" (Cumberland Futures Committee, 1987).

One of the goals of the Nova Scotia Wildlife Policy is to maintain the diversity of native wildlife species in their natural habitat. In addition, the government of Nova Scotia will ensure that valuable wildlife habitat and the long term diversity and stability of wetlands are protected (Nova Scotia, 1987). This will involve implementing policies for the conservation of wildlife habitats.

Increased habitat diversity and stable water levels will produce good habitat for a wide range of aquatic and semi-aquatic birds, mammals, amphibians and

reptiles, based on experience at the Fort Lawrence Marsh near Amherst.

Wildlife Populations

Population counts of wildlife in the Minudie dykelands have not been undertaken so it is difficult to estimate the potential impact of a freshwater marsh on wildlife populations. The species found on the Minudie dykelands under existing conditions include; deer, muskrat, minks, hawks, owls, voles, fox, song sparrows, and seasonal use by black ducks and geese (McAloney, 1989).

In a managed wetland situation, it is considered that the species diversity would increase to include: deer, muskrat, mink, raccoon, fox, terns, bitterns, rails, coots, grebes, wrens, blackbirds, kingbirds, Black Tern, Black Duck, and Ring-Necked duck (McAloney, 1989). The Nova Scotia Provincial Lands and Forests Act (R.S.N.S. 1967, C.163) does allow for the creation of wildlife management areas to protect wildlife and waterfowl habitat and provide opportunities for natural history education and outdoor recreation.

In a best case result, the hypothetical Minudie dykeland may be able to produce species diversity and productivities similar to the Chignecto National Wildlife Area. Wildlife surveys and counts for that area are provided by Barkhouse (1984).

Rare/Endangered Species

The only endangered species found in the area is the Peregrine Falcon (Falco peregrinus) which are considered to be a rare transient. The Canadian Wildlife Service has been releasing young Peregrine falcons in Fundy National Park, New Brunswick and at Advocate, Nova Scotia. Breeding sites have not been identified in the area.

Wildlife Use

No statistics on recreational hunting on the Minudie dykelands are on record. However, hunting and trapping do occur in the area with muskrat, deer and fox being the species of interest. None of these species would be adversely affected by the creation of a freshwater marsh in the area. Waterfowl would make more use of the area as a wetland, which would increase the recreational hunting potential of the area.

Statistics on the origins of hunters who hunted at Wallace Bay on the Northumberland Strait shore of Cumberland County show that the area is beginning to attract hunters from as far away as the Halifax area. From the experience of a waterfowl hunting lodge that has recently begun operating in Prince Edward Island, there is a large potential demand for waterfowl hunting in the Maritimes (personal communication, Jim Duggan, Managing Director, Wild Goose Lodge).

Wildlife-related activities generated $358.6 million in gross production, $180.6 in income and 8,950 jobs in Nova Scotia and New Brunswick in 1981 (Jacquemot et al., 1986). Waterfowl hunting had a net economic value of $4.8 million in Nova Scotia and New Brunswick in 1981, while total hunting had a net economic value of $40.4 million (Jacquemot et al., 1986). The estimated retrieved kill of waterfowl in Nova Scotia and New Brunswick in 1981

was 172,604 ducks and 11,915 geese (Metras and Wendt, 1986).

Ducks Unlimited Canada is willing to invest in habitat up to $21 per duck produced. As noted previously, in the case of the Minudie dykelands, this would suggest a value of $105 per hectare-year, or $1050 per hectare at a real discount rate of 10%.

In the Provincial Wildlife Policy, the Nova Scotia government recognizes hunting as providing direct social and economic benefits to Nova Scotians and states as its policy to "ensure that hunting and trapping will not endanger the well being of wildlife populations." In order to fulfill this policy, the Nova Scotia government may need to reduce harvesting pressure or increase wildlife by providing habitat in areas such as the Minudie dykelands.

Recreation

Recreational activities that could occur in the area would include naturalist activities, hiking and snowmobiling. At the present time, the Minudie dykeland is not used extensively for recreation purposes due to its isolation as well as the proximity of alternative wetland areas. Increased availability of freshwater marshland in the area may affect the recreational use of the area, although actual use will depend on access, facilities and awareness among local and visitor populations. As noted above (under "Wildlife Availability"), the Cumberland Futures Committee supports the development of wildfowl marshes as major tourist attractions.

Economic Production

Values from consumptive use of a wetland on the Minudie dykelands has been estimated by McAloney for a 20 year lease (McAloney, 1989). Muskrat was seen as having the highest value: Muskrat harvest was estimated at 7.5 per acre (18.8 per ha) assuming 4/5 of the area in production each year (i.e. 5 year drawdown cycle). Given a total area of 259 hectares, this yields a total of:

18.8 muskrats/hectare-year x 207 hectares = 3895 muskrats

which, assuming an average price of $5.00 per muskrat, yields:

3895 muskrats/year x $5/muskrat x 20years = $389,500

Other species such as mink, raccoon and fox are also of economic importance on a small scale. For the net value of economic production from fur-bearing animals, it is necessary to subtract costs of production, including labour costs. Alternatively, to the extent that trapping may be considered a recreational activity, the additional value realized through recreation should be considered.

Education and Scientific Research

Educational and scientific research interest in the Minudie dykelands has been negligible in the past. The combined factors of distance from Amherst, and the proximity of other sites may affect the use of the Minudie area for educational activities. In addition, access and developed facilities will affect the use of the area by local schools and groups. In this regard, there are other possible attractions in the Minudie area, such as the Minudie School House Museum, the "King" Seaman House, and the "blessing of the crops" each year at Minudie (which attracts up to 100 people), not to mention the cliffs at nearby Joggins, which are a popular site for fossil- and rock-hunting.

Alternately, the isolation and absence of visitors might make freshwater marshland on the Minudie dykelands an attractive place for research projects.

Uniqueness

A freshwater marsh on the Minudie dykelands would provide habitat that is represented elsewhere in the region. However, the fact that the marsh would be on the Atlantic Flyway gives the area regional importance as a stopover site for migrating birds. If the site were managed to provide and enhance migratory feeding, the value of the area on a regional basis would increase.

Quantity

Managed freshwater wetlands are abundant in the area relative to other areas of the Maritime Provinces, but it is not clear if they are abundant relative to potential wildlife use and productivity. Federal and provincial governments have general policy statements with regard to wetlands and wildlife which should have implications for the total area and geographic distribution of land which is considered appropriate for wetland conservation, but it remains to be determined what these policies mean "on the ground". Governments, especially at the provincial level, also have policies to maintain or expand the area of land in agricultural production.

Results from application of the Cumulative Impact Approach, including information and policy gaps which were identified, are summarized in Table 6.1.

6.2 Conclusions

The most compelling wetlands criteria which have a bearing on the hypothetical wetland on the Minudie dykelands are the North American Waterfowl Management Plan and the Eastern Habitat Joint Venture. These plans establish quantitative goals for the establishment of new waterfowl habitat in eastern Canada. Potential waterfowl habitat sites in the Chignecto area would be especially valuable in fulfilling these goals, because they would be directly on the Atlantic Flyway. However, there are other potential sites for creating waterfowl habitat in the Chignecto area, in addition to the Minudie dykelands.

What appear to be missing in terms of application of the Cumulative Assessment Method in this case are middle-level policies and criteria which can be used to specify the appropriateness of a given site in terms of the achievement of waterfowl production goals. There are apparently no criteria which can be applied on a regional basis to assign priorities and select among potential sites for habitat creation. Golet scores provide some indication of the relative values of wetlands as habitat, but there are no corresponding measures of the opportunity costs of preserving or establishing sites as wetlands.

TABLE 6.1
CUMULATIVE ASSESSMENT MATRIX: MINUDIE

SOCIALLY VALUED ATTRIBUTE	CRITERIA	APPLICATION OF INDICATORS	GAPS
STAGE ONE OF ASSESSMENT			
Cost-Effectiveness of Proposed Activity	1. Is the proposed activity economically viable in the short term? in the long term?	Based on data provided by the N.S. Department of Agriculture and Marketing, use of the Minudie dykelands as pasture is economically viable in short/long term.	Costs and benefits based on prevailing prices may not reflect social costs and benefits, because prices may be distorted by subsidies, unaccounted externalities, etc.
STAGE TWO OF ASSESSMENT			
Evaluate Alternatives	1. Is there a viable alternative to the current use of the potential wetland? - alternative location - alternative design - alternative way of achieving goals of current use	There are alternative land areas (e.g. 14,044 hectares of abandoned farmland) in the vicinity which could be used for the farming currently practised on the Minudie dykelands.	Although it is likely that farming activity on at least some of these alternative areas is at least as viable as on the Minudie dykelands, this has not been ascertained. Recommend analysis like that of Jackson and Maxwell (1971).
STAGE THREE OF ASSESSMENT			
Water quality (risk reduction)	1. Water Quality Does the current dykeland use or proposed wetland use enhance or reduce water quality? 2. Water Quality: toxics Does the current or proposed activity affect toxic input or toxic retention?	Both uses have negligible impacts on water pH, BOD, temperature, turbidity, etc. There are no human users downstream. Possibly some toxic input from current hay production. Wetland might retain and recycle inputs better.	There is no data on water quality on the Minudie dykelands, but there is no reason to believe that it is below standard for its uses. Lack of research on toxic inputs from farming practices and deposition, and on fate on different land types.
Water Quantity Management a) flood damage reduction b) aquifer recharge c) erosion management	3. Does current use or proposed use alter flood storage capacity; affect streamflow and drainage; groundwater recharge?	Wetland may have greater storage capacity. There are no human users downstream affected by changes in water flow.	There are no measurements of erosion on the Minudie dykelands, but there is no reason to believe that erosion might be a problem.
Wildlife Availability	4. Habitat Quantity, Quality and diversity.	High Golet score for wetland. Species diversity for current and proposed use indicated in Appendix 1.	No quantitative habitat assessment (especially for particular species)
	5. Wildlife Populations	Likely to be similar to other similar areas nearby (e.g. Amherst Point)	No assessment of differences between Minudie and other areas yielding different densities.
	6. Rare, threatened, endangered or regionally significant species	Peregrine falcon being reintroduced into vicinity. Eurasian kestrel recent visitor to dykeland.	No complete species surveys.
Wildlife Utilization (Recreation) (Way of Life)	7. Existence of consumptive or non-consumptive uses of wildlife.	Some hunting and picking of plants on dykelands. Area used by naturalists and sportsmen. Likely muskrat harvest and waterfowl on marsh shown in Appendix 1.	No quantitative data on utilization. (Some indications from surveys, see Chapter 4.)
Recreation Consumptive Use - Hunting - Fishing - Collecting Non-consumptive Use - Feeding wildlife - Photography - Collecting - Viewing (landscapes) - Hiking, skiing - Snowmobiling	8. Does the proposed alteration increase or decrease the quantity and the quality of recreation opportunities?	Current and potential use of dykeland and wetland mainly for hunting, viewing, and hiking. Increased waterfowl hunting with wetland. Willingness-to-pay from surveys shown in Chapter 4.	No quantitative surveys of current and potential uses.

TABLE 6.1 (continued)
CUMULATIVE ASSESSMENT MATRIX: MINUDIE (continued)

SOCIALLY VALUED ATTRIBUTE	CRITERIA	APPLICATION OF INDICATORS	GAPS
STAGE THREE OF ASSESSMENT (continued)			
Commercial Plant, Animal and Fish Production for Direct Economic Use: - wild rice - cranberries - blue berries - timber production - hay and cattle - game farming - aquaculture - commercial trapping	9. Would the wetland increase or reduce the economic potential for production from the resource base?	Current dykeland harvest: cattle, $30-$160/hectare-year; hay, ~$0/hectare-year. Potential wetland harvest: muskrat, $60/hectare-year. (harvest value net of production costs).	Other potential harvests not considered to be economically viable, but no complete feasibility studies have been conducted.
Education, scientific	10. Contribution to Education and Research	Site is remote compared with other similar sites for educational and research use. Dykelands of some historic interest and heritage value. Recent finds of 200-year-old aboiteau.	No records or projections of frequencies of educational and research use.
Unique National or Regional Resource	11. Conservation of unusual, unique and representative wetlands. A unique ecosystem.	The only qualities of uniqueness of the site are its large expanse and setting.	There are no official criteria of "uniqueness" applicable to land use planning in this case.
Access to Socially Valued Wetlands; Ecosystem Diversity	12. Regional Scarcity Are there quantitative thresholds established for wetlands within the regions, provinces, or national eco-zones? Does the wetland support an extensive ecosystem complex including uplands?	The North American Waterfowl Management Plan calls for an additional 4,000 hectares of black duck habitat on the east coast of Canada from 1986 to 2000. The Eastern Habitat Joint Venture has budgeted for the creation and protection of 10,000 hectares of wetland habitat in eastern Canada.	There are no criteria for determining where new habitat should be created, or for the allocation of public lands (e.g. the Minudie dykelands) for this purpose.
STAGE FOUR OF ASSESSMENT			
Mitigation	Can the negative effects be adequately mitigated to remove the adverse impacts on the key wetland functions valued by society (as listed under socially valued attributes in Stage 3)?	It may be possible to reconcile agricultural and wetlands uses to some extent through a multiple use concept.	Conservationists and agriculturalists have not developed a mutually satisfactory multiple use concept for the Minudie dykelands.

CHAPTER 7
CONCLUSIONS AND CRITICAL REVIEW OF THE EVALUATION METHODOLOGIES

In general, application of the three evaluation methodologies to the hypothetical Minudie wetland, given current economic conditions and social preferences, suggests that establishment of the hypothetical wetland would increase the net social benefits derived from this area over those derived from its present uses. Some uncertainty remains regarding this conclusion, because the only significant wetland values in this case are from wildlife production, and, given current social values, the magnitude of the net benefits from wildlife production is within the range of uncertainty of our evaluation estimates. The outcome would probably have been more clear if the wetland alternative offered other benefits, in addition to wildlife benefits. It would also probably have been more clear if the evaluation methodologies better incorporated some of the considerations suggested below.

Application of the evaluation methodologies in this case has revealed several theoretical and practical issues. Some of these issues which relate to the application of each particular methodology were raised in the chapter devoted to that methodology. Here, some of the more general issues raised by application of the methodologies are discussed under two headings: 1) economic issues, and 2) ecological issues.

5.1 Economic issues

1) Although the hypothetical nature of the wetland proposal in the present pilot study contributes to some problems for each of the methodologies, it creates particular difficulties for survey respondents who are asked to assign a value to the area, or to their use of the area. Use of the site may depend upon facilities, access and congestion which are difficult to estimate in a hypothetical situation. Further problems can be encountered in determining the potential demand for using the area when there are alternate sites available. For example, people may be unwilling to "pay" for hunting privileges in the proposed wetland when there are "free" alternative sites nearby, such as other managed marshlands.

2) A further potential problem with the contingent valuation method is the choice between "willingness-to-pay" and "willingness-to-sell" or "compensation demanded" as measures of value. Until recently, economists tended to assume that these two measures yielded equal results. There is growing evidence, however, that compensation demanded may typically be three to ten times larger than willingness-to-pay. In the present case, the appropriate measure of value for a freshwater marsh on the Minudie Dykelands is probably willingness-to-pay, because the land would have to be "acquired" for this purpose. However, it would probably be misleading to generalize this willingness-to-pay as representative of the value of existing wetlands which may be subject to alienations to other uses.

3) Although the creation of the wetland would not be completely irreversible, the cost of building the extra dykes to flood the area would make reverting back to agricultural land use an expensive proposition. This brings into question the "quasi-option" values associated with the site alteration (see, e.g. Freeman, 1984). These values are not taken into consideration in any of

the methodologies being tested.

4) Perhaps most important of all these considerations in the present case, the evaluation methodologies do not explicitly take into account the likelihood of future increases in the values of resources and amenities (such as wetlands) relative to manufactured (or "secondary") goods. There are fundamental trends which suggest to economists that such relative increases are likely: technical advances tend to make products relatively cheaper than resources and amenities, while cumulative losses of resources and amenities, and increases in demand for them, also tend to make them more valuable. Some of the evaluation methods applied here may implicitly take this into account: the Wetland Evaluation Technique appears to give less attention to the actual demand for wetland functions than to the potential demand, while some of the conservation policies cited in the Cumulative Assessment Method may be based implicitly on such expectations. It may be fruitful to consider if it is possible to determine more quantitatively the rate of future increases in the relative value of wetlands, in a manner such as that suggested by Krutilla (1967), Krutilla and Fisher (1975) and Howe (1979).

5). Another point, related to the above, is that none of the methodologies explicitly incorporates intergenerational equity in its criteria of evaluation. By not taking account of intergenerational equity, the methodologies also fail to take account of sustainability, which is usually defined in terms of intergenerational equity, i.e. as the requirement "to ensure that economic development meets the needs of the present generation without compromising the ability of future generations to meet their own needs". Again, it may be argued that some of the methods implicitly take intergenerational equity into account. If so, it bears asking how well they do this, and if they could do it better by introducing more explicit, and even quantitative, criteria.

6). All of the evaluation methodologies are consistent with conventional economic analysis in taking current preferences and values as given, unquestionnable standards of value. In practice, preferences and values are not immutable. Large sums of money are spent on advertising to increase people's preferences for manufactured goods and services, while, with the possible exception of expenditures on tourism promotion, there are almost no efforts to increase the general public's preferences for environmental amenities. This issue arose in the context of the present study with regard to whether it was appropriate to adopt a "marketing approach" to the hypothetical Minudie wetland. In particular, it is difficult to determine how far the survey instruments should go in "advertising" potential wetland benefits. Furthermore, there were unresolved issues with regard to how "developed" the hypothetical wetland would be: how intensively it would be managed or whether it would be left in a "natural" state, if it would be oriented toward any particular uses, what associated facilites would be provided, etc.

7). The above consideration raises the more general question of whether there may be a misplaced effort towards attainning "objectivity" in the evaluation methodologies. Preferences may not only be mutable, but unstable and even irrational. Rational preferences and choices can only be formed by people talking and listening together to explore options and consequences of these options. This is the authentic alternative to the marketing or propagandistic approach. Such an alternative would not aim toward the

presumed "objectivity" of the evaluation methodologies applied here, but would be much more participative. Communities would be invited to develop their own options for the development, use and conservation of their natural heritage. In this approach, the processes of information gathering, mutual education about the value of natural heritage, and development of institutional arrangements to conserve that heritage would be combined, and would be based in communities themselves. Some methods and incentives for promoting conservation of biological resources at the community level are suggested by McNeely (1988).

7.2 Ecological Issues

1). The interactions between a wetland area on the Minudie dykeland and the other managed freshwater marshes in the region need to be taken into consideration. Other marshes in the immediate vicinity could have substantial influence on the wildlife populations and diversity in the proposed wetland. In the worst case, the creation of an additional wetland may attract waterfowl and other wildlife from an adjacent managed area, resulting in no real gain in benefits from habitat expansion. A more likely outcome is suggested below, but this "worst case" cannot be excluded from the range of possibilities.

2). In the present case, in particular, the wildlife species of greatest interest are migrating birds. Therefore, the economic analysis should span the full geographical and ecological range of these species, considering, for example, how impacts of pollution and restraints on hunting pressure, as well as the provision of various kinds of habitat, affect populations and species diversity. An economic analysis which attempted to provide this broader view with regard to waterfowl of the Great Plains was conducted over a decade ago by Hammack and Brown (1974).

3). The only wetland option for the Minudie dykelands which was considered at length in this study was the freshwater wetland option developed at the project workshop, and subsequently refined by Mr. Keith McAloney (Provincial Biologist, Ducks Unlimited Canada). Another wetland option would be to restore part of the dykelands to its original condition (before European settlement) as saltmarsh. Saltmarsh would not be as productive for waterfowl as freshwater marsh, but it could offer greater benefits for shorebirds, and for sediment capture and nutrient input in relation to the marine ecosystem of the Cumberland Basin. These functions would be negligible in the case of the freshwater wetland option. If the goal of wetland creation in the Chignecto region was to restore the ecosystem to something resembling its original state, so that it could support the species diversity and productivity associated with that state, this would be accomplished most by creating saltmarsh from the Minudie dykelands, rather than freshwater marsh. It is evident from the preferences of wildlife conservationists that this is not their goal, but it is not clear what their goal is <u>at the ecosystem level</u>. If that goal was better enunciated, planning of wetland restoration could be made more rational and scientifically sound, and justification of wetland restoration would be easier, at least in terms of the Cumulative Assessment Method.

4). Generalizing further these considerations, there are also problems in assigning a value to a particular area without looking at the regional context of which it is a part. This raises questions about the viability of the economic models which tend to reduce variables to single components, and are

unable to deal with the interactions and values at a larger ecosystem level. These problems are compounded by the difficulties of trying to determine marginal, as opposed to average, costs and benefits. This study took as its starting point a particular potential wetland area. In the course of the study, especially in the opportunity cost approach, it was necessary to evaluate (at least implicitly) the relative merits of this site compared with other potential sites in the region. In theory, this should have involved evaluation of all alternative sites not only for wetland creation, but also for agriculture. However, this was not possible within the compass of this study. In retrospect, it might have been more useful to have begun with a regional perspective, and inquired where, within the region, are the most appropriate locations for wetlands creation and for agricultural activities. The lack of a regional perspective has been identified as one of the major problems in conserving coastal wetlands in California, which provide habitats for several endangered species, such as the California least tern, light-footed clapper rail and the California brown pelican (Zedler, 1988):

> "Proposed projects are planned and reviewed individually rather than with a regional perspective. While cumulative impacts may be considered, there is no regional coordination to set priorities and guide decision-making. There is no way to ensure that the wetlands with the greatest potential for maintaining clapper rails will be managed for clapper rails."

There has not only been a lack of a regional perspective, but also lack of an ecosystem perspective:

> "Wetland restoration assessments have not been made for entire ecosystems but have been limited to one or a few target species... No studies have been conducted to determine the minimum wetland area or configuration of multiple wetlands required to maintain regional biodiversity." (Zedler, 1988)

There is substantial evidence that the area of wetland remaining has already fallen far below the area required to maintain the original biodiversity in Southern California, where four wetland-dependent species have become endangered while coastal wetlands have shrunk by 75% (Zedler, 1988):

> "There is some minimum area required to support regional biodiversity and a limit to the number of species that can be packed into individual wetlands. Populations are dynamic; some migrate and use several wetlands, whereas others experience local declines and must reinvade from another refuge. The need to maximize area available for wetland species is indicated by population declines that have followed human disturbance and environmental catastrophes." (Zedler, 1988)

These considerations reinforce the need to apply a broader regional-ecological perspective to the whole Chignecto area. They also provide further justification for the argument that other managed freshwater wetlands are needed in the Chignecto area, such as the hypothetical Minudie wetland, to provide habitat in order to ensure maintenance of the biodiversity which the area can support, as currently manifest only at the Amherst Point Sanctuary.

To develop a broader regional-ecological perspective, it may even be possible to build useful ecosystem models on top of the geographic information system which is being developed for the area (Arbour and Wilson, 1988). It may also be possible to apply some of the concepts and methods of landscape ecology. These models and methods should provide some guidance on the best locations and configurations of wetlands.

At the same time, studies might be conducted on the best locations and configurations of land to support profitable agricultural operations. Such a study for the Tantramar area (Jackson and Maxwell, 1971) concluded that policies should encourage the consolidation of agricultural activities within two "agricultural nodes", which, because of a variety of factors (land quality, access to services and markets, etc.), were found to be best able to support profitable agriculture. Land outside these nodes could then be available for wildlife habitat and recreation. Unfortunately, this Tantramar study did not cover the Nova Scotian side of the Chignecto area, where the present study area is located. On the basis of such studies, however, it should be possible to determine the best configurations of sites for agriculture and wetlands conservation, in a way which minimizes any conflicts between the two.

5). At the workshop for the present study, some participants made reference to purported benefits from "multiple use" of land areas, especially "multiple use" for agriculture and wildlife conservation; other participants were sceptical about such benefits. No attempt has been made to reach any conclusions about such benefits in this case. Suffice it to say that none of the methodologies applied in this study offer any guidance with regard to recognizing or evaluating benefits of "multiple use".

CHAPTER 8
GENERAL METHODOLOGICAL RECOMMENDATIONS

1). One aspect of the application of the evaluation methods in this case that was very useful, if not indispensible, for obtaining results in the time that was available was the convening early in the project of a workshop with about 25 participants (see Appendix 6) who were particularly knowledgeable about the study area, especially with regard to conservation and agriculture. This is highly recommended, where feasible, as a method for initial scoping and identification of information sources.

2). The willingness-to-pay evaluation method was not successful in this case, because there were too many possible sources of misunderstanding and ambiguity in the surveys for the results to be trusted. It is very difficult to remove such potential sources of misunderstanding from surveys without making them very wordy, and thus risking losing the attention of respondents. As suggested at the end of Chapter 4, if the willingness-to-pay method is to be used again in a similar situation, it should only be conducted among participants at the end of a workshop in which they have an opportunity to gain a thorough understanding of the proposals and alternatives that they are evaluating.

3). The willingness-to-pay method was only applied to local wetland beneficiaries in this study. Nevertheless, we know that there are beneficiaries of the Chignecto wetlands all along the flyways of the migratory birds that use these wetlands as habitat (and possibly further afield, if one considers existence values). This is apparent in that funding for the conservation of the Chignecto wetlands is derived by Ducks Unlimited Canada, the North American Waterfowl Management Plan and the Eastern Habitat Joint Venture from sources spanning the North American continent (or, at least, the eastern part of it). Methods should be developed to measure and include the willingness-to-pay (including wildlife use values as well as existence values) of non-local wetland beneficiaries. The study of Hammack and Brown (1974) suggests an approach for developing such methods.

4). The opportunity cost method appeared to be the most applicable of the three evaluation methods in this case. The method could have been executed more throughly by adapting and parameterizing the method of Gupta and Foster (1975) for the Maritimes. This would have been especially worthwhile if there had been many wetlands or potential wetlands in the Maritimes to be evaluated. Furthermore, a complete application of the opportunity cost method would lead naturally to expanding the scope of evaluation to a regional perspective. The kind of assessment conducted by Jackson and Maxwell (1971) would then be appropriate. Jackson and Maxwell used land capability ratings in their assessment. It might be worth attempting an adaptation of the method of Gupta and Foster that uses land capability ratings instead of, or in addition to, the ratings systems that they used (developed by Golet and Smardon).

5). The cumulative impact approach produced uneven results in this case, because there were few applicable criteria and policies from which indicators could be derived. The most decisive stage of the approach in this case was stage two, which corresponds to the opportunity cost method. In general, however, it is not clear how to draw an overall conclusion from the cumulative

impact approach when there is no compelling result from considering any particular socially valued attribute. Nevertheless, the cumulative impact approach is very useful, and probably indispensible, for initial scoping, and it is recommended that it continue to be developed and used for this purpose.

6). There is a substantial amount of overlap and tedious repetition in conducting the initial scoping and applying the three methods. The whole process could be made more efficient and less tedious if it was formulated in terms of a flowchart or decision tree, and perhaps even implemented as a knowledge-based (or "expert") system on a computer. Such a system could be programmed to give the user recommendations, where appropriate, about factors to be considered and possible sources of information. Designing such a system would be a good demonstration and test of what has been learned from the "Wetlands are not Wastelands" project. It would also yield a product that local planners would probably find more congenial to use than a written manual. Furthermore, such a system could be easily revised and updated to reflect growing experience and knowledge as it is applied to different cases. There is a precedent for designing computer systems for this purpose, in that the Wetland Evaluation Technique (Adamus et al., 1987) has been developed into such a system.

Overall, it appears from this study that the best method that a regional planner could use in this case to undertake a "quick and dirty" study (or a longer study, if warranted) to advise a regional or county council about a proposed wetland alienation or development is the opportunity cost method, incorporating some variant of the method of Gupta and Foster (1975). The cumulative impact method should be used for initial scoping, but it is unlikely that this method by itself would be conclusive in the Maritimes, because it depends on conservation policies and criteria which are not sufficiently developed in this region.

Ducks Unlimited Canada

P.O. Box 430
Amherst, Nova Scotia
B4H 3Z5

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Dr. Peter Stokoe
School for Resource and
Environmental Studies
Dalhousie University
1312 Robie Street
Halifax, Nova Scotia
B3H 2E2

Dear Peter:

Following yesterday's workshop, I decided to work up a proposal for the development of 5 impoundments at Minudie. While these are hypothetical, I felt the proposal would give you a better basis for socio-economic comparisons.

All segments are laid out on what is now pasture, in that it is not intensively ditched or land-farmed so cost opportunity would be the income from pasture. Please keep in mind that for the past 15 years, the Department of Agriculture had leased Minudie to a farmer at about the same cost per acre as their maintenance cost so there was no net income to the province and very little income to the local residents. (part time work for a sheep farmer during lambing and haying seasons)

The following page summarizes costs and benefits for the proposal over a 20 year lease period.

I hope this is of some help to you.

Yours truly,

Keith

Keith McAloney
Provincial Biologist

c.c. Al Smith
Fred Payne
Hank Kolstee

COSTS FOR 20 YEAR WETLAND PROPOSAL

Parameters: (1) All inside dyke at $5 per linear foot.

(2) Pre-fab control structures at $6,000 per unit installed.

(3) Perimeter fancing at $1.00 per foot.

(4) Dyke maintenance at $5.00 per acre per year.

(5) Muskrat harvest at 7.5 per acre/yr.

(6) Duck production at 1 brood per 3 acres.

(7) Vegetation control with cookie cutter at $70.00 per acre.

(8) Muskrat pelt prices expected to range between $4 and $8 over 20 yr. period.

TABLE I Conversion Costs

SEGMENT	AC	HA	FT. OF DYKE	TOTAL COST	COST/HA.
1	160	64	8330'	$47,650	$745.00
2	144	58	6456'	38,280	660.00
3	64	26	3332'	22,660	872.00
4	128	51	7915'	45,575	894.00
5	150	60	7915'	45,575	760.00
TOTAL:	646	259	33,948	$199,740	$771.00

Potential Additional Costs:

13,745 feet of fence if rest of Minudie is pasture = $13,745

Possible alteration of existing drainage patterns = 5,000

Total Development Cost = $218,485

Potential Maintenance Costs:

Dykes = 646 x 5 x 20 =	64,600
Vegetation Control = 646 x 70 =	45,220
Lease = 646 x 5 x 20 =	64,600
	$174,420

Total Proposal Cost over 20 Years = $218,485 + $174,420

= $392,905

EXPECTED BENEFITS OVER 20 YEARS

1. Muskrat harvest at 7.5 per acre (18.8 per ha) assuming 4/5 of area in production each year (i.e. 5 year drawdown cycle) = 18.8 x 207 = 3895

   Assuming an average price of $5.00 = 3895 x 5 x 20 = $389,500

   Miscellaneous species (mink, raccoon, fox) 1000 x 20 = $20,000

2. Waterfowl production at 1 brood per 3 acres or 1.2 ha:

   215 broods x 6 ducklings x 20 years = 25,800

3. Increase in species diversity:

Existing Pasture	Managed Wetlands
Deer	Deer, muskrat, mink, raccoon, fox.
Muskrat	Herons, bitterns, rails, coots, grebes.
Mink	Wrens, blackbirds, kingbirds, black tern.
Hawks	Black duck, wigeon, Blue-winged teal, pintail.
Owls	Green-winged teal, shoveller, wood ducks.
Vales	Ring-necked duck
Fox	
Song Sparrow	
Seasonal use by black ducks and geese.	

PUBLIC

Appendix 2

No._____

RESPONSE SHEET

GENERAL PUBLIC TELEPHONE SURVEY

DETERMINATION OF VALUE-IN-USE, OPTION VALUES, AND SOCIAL VALUES FOR PART OF THE MINUDIE DYKELAND AS A FRESHWATER MARSH

Date: _____ Time:_____

Name: _____

Phone No.: _____

Hello, is this _____? (identify if an adult in the household)
This is _____ calling about a research project that I'm helping to conduct for Environment Canada. We are researching the uses and values of wetlands in several areas across Canada.
Could we have a few minutes of your time?
(If no: Record _____)

To begin, we would like your response to several questions concerning wetlands in general. Are you familiar with the term "wetland"? _____
What we mean are those areas usually called marshes, swamps, bogs, etc.
Have you ever visited wetlands in this area? _____ (i.e. the Chignecto area)
(If no, go to Non-Users section.)
(If yes, go to Users section.)

USERS

What was the principal purpose for your visit(s)? _____
Would you have visited wetlands in this area if (that use) was unavailable? __
What other reasons would attract you? _____
How many times during the past year have you visited wetlands in this area? __
If it cost you more to visit wetlands (say because you lived further away and had to spend more to get there), what is the maximum amount you would be willing to spend before you would stop visiting wetlands? $_____

We would now like to ask about one area in particular, the Minudie dykeland or Elysian fields. This area is NOT currently a wetland, but rather a drained dykeland. However, we would like to determine how people in your area would value the Minudie dykeland if PART of its area was converted to a freshwater marsh.

Are you familiar with the Minudie dykeland or Elysian fields area? _____
(If not, locate the area for the respondent:
an area of about 3,000 acres of dykeland near Minudie (beyond River Hebert), that sticks out into the Cumberland Basin toward Amherst)

1. Have you ever visited this area? _____
(If yes, go to 1a)
(If no, go to 1b)

1a. About how many times in the past five years? _____
... how may times within the last year? _____
what were the purposes of your visit[s]?
_____

Do you think that you might make greater use of the Minudie dykelands if part of it was to be converted to freshwater marsh? ___
(If no, go to RESPONDENT CHARACTERISTICS.)
(If yes, go to 2)

1b. Do you think that you might use the Minudie dykelands if part of it was to be converted to freshwater marsh? _____
(If no, go to RESPONDENT CHARACTERISTICS.)
(If yes, go to 2)

2. How much (greater) use would you make? _____
_____

3. Do you think that any effort or money should be used to convert part of the Minudie dykelands to a freshwater marsh, which could be used for free by you and other members of the public? _____
(If no, go to RESPONDENT CHARACTERISTICS.)
(If yes), what would be the most appropriate organization for allocating this effort or money? _____
(If no response: _____) then would you consider:
nature organizations? _____
a community board of management? _____
the provincial government? _____

4. If the (organization) asked for contributions from the public for the cost of converting part of the Minudie dykelands to freshwater marsh, how much would you, as an individual, be willing to contribute (as a one-time contribution) toward this?

Would you be willing to pay $_____?

(Choose randomly $20, $40, $60, $80, $100 or $200 and note above)

(If protest, will not answer) Why?

(no extra value for you _____)

(not able to contribute _____)

(it's my right _____)

(taxes already pay for this type of thing _____)

(refuse to estimate _____)

(If respondent accepts this dollar figure, work the dollar figures upwards in 2x increments until the response is no.)

(If respondent does not accept this dollar value, work dollar figures downwards in 0.5x increments until the response is yes.)

(Record highest acceptable value for willingness to pay $_____)

5. Suppose instead that an organization was interested in converting part of the Minudie dykelands to freshwater marsh to create a multiple use area, and charge for admission for a day of your use of this area.

What would be the most appropriate organization to do this? _____

(If no response: _____) then would you consider:

nature organizations? _____

a community board of management? _____

a private developer? _____

the provincial government? _____

In this case, would you be willing to pay an admission charge of $_____ for a day's use of this area?

(Choose randomly $2, $4, $6, $8, $10, $20 and note above)

(If protest, will not answer) Why?

(no extra value for you _____)

(not able to contribute _____)

(it's my right _____)

(taxes already pay for this type of thing _____)

(refuse to estimate _____)

(If respondent accepts this dollar figure, work the dollar figures upwards in 2x increments until the response is no.)

(If respondent does not accept this dollar value, work dollar figures downwards in 0.5x increments until the response is yes.)

(Record highest acceptable value for willingness to pay $_____)

(Go to RESPONDENTS CHARACTERISTICS section.)

NON-USERS

1. Although you don't visit wetlands in this area, are there specific uses or other values that you see as coming from these wetlands? What are these? (list)

_____

(for values not identified, inquire): Do you think that wetlands in this area are useful for:

- groundwater recharge?
- controlling, or providing protection from, flooding?
- improving water quality
- producing game and fish?
- preserving endangered species?
- recreation?

2. Do you think that any effort or money should be used to conserve wetlands in this area? _____

(If no, go to RESPONDENT CHARACTERISTICS.)

3. Given a hypothetical situation, suppose that some organization was to establish a fund to purchase wetlands in this area in order to assure that all these values would continue, or that the wetlands would be there for you and others to use in the future, what organization would be most appropriate for this?

_____

(If no response: _____) then would you consider:

nature organizations? _____

local government? _____

the provincial government? _____

4. In this case, how much would you, as an individual, be willing to contribute (as a one-time contribution) to (this organization's) fund for wetlands? Would you be willing to pay $_____?

(Choose randomly $20, $40, $60, $80, $100, $200 and note above)

(If protest, will not answer) Why?

(no extra value for you _____)

(not able to contribute _____)

(it's my right _____)

(taxes already pay for this type of thing _____)

(refuse to estimate _____)

(If respondent accepts this dollar figure, work the dollar figures upwards in 2x increments until the response is no.)

(If respondent does not accept this dollar value, work dollar figures downwards in 0.5x increments until the response is yes.)

(Record highest acceptable value for willingness to pay $_____)

RESPONDENT CHARACTERISTICS

I would like now to ask you five questions about yourself. These will be used for statistical purposes only (so that we can determine if our survey sample is representative of the population as a whole); you will not in any way be identified.

Male or Female _____

How would you describe your family status?

a) single _____
b) married, no children _____
c) married, with children _____
d) other, no children _____
e) other, with children _____

In what range does your age fall?

a) under 20 _____
b) 20-34 _____
c) 35-49 _____
d) 50-64 _____
e) 65 and over _____

What is the highest education level you have attained?

a) grade school _____
b) some high school _____
c) high school graduate _____
d) some post-secondary _____
e) degree held _____

How would you characterize your employment status?

a) employed _____
b) homemaker _____
c) student _____
d) retired _____
e) other _____

In what range does your family income fall? (emphasize "family")

a) under $10,000 _____
b) $10,000 - $20,000 _____
c) $20,000 - $30,000 _____
d) $30,000 - $40,000 _____
e) $40,000 and over _____

Appendix 3

NATURALISTS
RESPONSE SHEET

This survey is being conducted for a project sponsored by Wildlife Habitat Canada and Environment Canada. The overall project is investigating the uses and values of wetland areas and potential wetland areas in several regions across Canada. Are you currently a user of wetland areas? _____

In the study for this region, we are principally interested in one area, the Minudie dykeland, also known as Elysian Fields. This area is NOT currently a wetland, but rather a drained dykeland. However, through this survey we are attempting to determine how people in your area would value the Minudue dykeland if PART of its area was converted to a freshwater marsh.

1). Have you ever visited the Minudie dykeland or Elysian Fields for nature-related activities? _____

If no, go to question 2).

If yes, about how many times in the past five years? _____

... how may times within the last year? _____

Are there any other reasons for you to visit this area?

_____

Do you think that you might make greater use, or derive greater benefits from your use, of the Minudie dykelands if part of it was to be converted to freshwater marsh? _____

If yes, go to SECTION A (page 2).

If no, go to SECTION B (page 3).

2). Do you think that you might visit the Minudie dykelands for nature-related activities if part of it was to be converted to freshwater marsh? _____

If yes, go to SECTION A (page 2).

If no, go to SECTION B (page 3).

SECTION A

3). How much greater use would you make, or what additional benefits would you derive from your use, of the Minudie dykelands if part of it was to be converted to freshwater marsh? _____

_____

4). What value would you place on these additional uses or benefits? _____

5). Do you think that any effort or money should be used to convert part of the Minudie dykelands to a freshwater marsh? _____
If yes, what would be the most appropriate organization for administering this effort or money? _____

6). If this organization asked for contributions from the public for the cost of converting part of the Minudie dykelands to freshwater marsh, which you and other members of the public could then use for free, how much would you, as an individual, be willing to contribute towards this?
Would you be willing to contribute: (circle one of the following)
$0.00 $20.00 $40.00 $60.00 $80.00 $100.00 $200.00 Other $_____

If $0.00, please explain why or check one of the following:
The freshwater marsh would have no value _____
Not able to pay _____
It's a right to say no _____
Taxes already pay for such things _____
Other _____

7). Suppose instead that an organization was interested in converting part of the Minudie dykelands to freshwater marsh, and charging a fee or admission charge for a day's use of this area. What would be the most appropriate organization to do this?
a nature organization: ____
a community board of management: ____
a private developer: ____
the provincial government: ____
other (specify): _____

In this case, what admission charge would you be willing to pay for a day's use of the area?
Would you be willing to pay: (circle one of the following)
$0.00 $20.00 $40.00 $60.00 $80.00 $100.00 $200.00 Other $_____

Please proceed to Section C.

SECTION B

8). You have indicated that you would not make greater use, or derive additional benefits from use of the Minudie dykelands, if part of the area were to be converted to freshwater marsh. However, do you think that a freshwater marsh on part of the Minudie dykelands would be useful for: (please check)

Wildlife habitat (game and fish) _____
Endangered species habitat _____
Recreation _____
Other (specify) _____

9). Do you think that any effort or money should be used to convert part of the Minudie dykelands to a freshwater marsh? _____
If no, proceed to Section C.
If yes, what would be the most appropriate organization for administering this effort or money? _____
_____

10). If this organization asked for contributions from the public for the cost of converting part of the Minudie dykelands to freshwater marsh, which would yield some of the benefits that you have noted in 8) above, how much would you, as an individual, be willing to contribute towards this? Would you be willing to contribute: (cirdle one of the following)

$0.00 $20.00 $40.00 $60.00 $80.00 $100.00 $200.00 Other $_____

If $0.00, please explain why or check one of the following:

The freshwater marsh would have no value _____
Not able to pay _____
It's a right to say no _____
Taxes already pay for such things _____
Other _____

Please proceed to Section C.

SECTION C

We would like you to answer five questions about yourself. These will be used for statistical purposes only (so that we can determine how closely our survey respondents represent the population); you will not in any way be identified.

Male or Female _____

How would you describe your family status?

a) single _____
b) married, no children _____
c) married, with children _____
d) other, no children _____
e) other, with children _____

In what range does your age fall?

a) under 20 _____
b) 20-34 _____
c) 35-49 _____
d) 50-64 _____
e) 65 and over _____

What is the highest education level you have attained?

a) grade school _____
b) some high school _____
c) high school graduate _____
d) some post-secondary _____
e) degree held _____

How would you characterize your employment status?

a) employed _____
b) homemaker _____
c) student _____
d) retired _____
e) other _____

In what range does your FAMILY income fall?

a) under $10 K _____
b) 10-19.9 K _____
c) 20-20.9 K _____
d) 30-30.9 K _____
e) 40 K and over _____

Thank-you for completing this survey.

Appendix 4

SPORTSMEN
RESPONSE SHEET

This survey is being conducted for a project sponsored by Wildlife Habitat Canada and Environment Canada. The overall project is investigating the uses and values of wetland areas and potential wetland areas in several regions across Canada. Are you currently a user of wetland areas? _____

In the study for this region, we are principally interested in one area, the Minudie dykeland, also known as Elysian Fields. This area is NOT currently a wetland, but rather a drained dykeland. However, through this survey we are attempting to determine how people in your area would value the Minudue dykeland if PART of its area was converted to a freshwater marsh.

1). Have you ever visited the Minudie dykeland or Elysian Fields for hunting?
_____

If no, go to question 2).
If yes, about how many times in the past five years? _____
... how may times within the last year? _____
Are there any other reasons for you to visit this area?
_____

Do you think that you might make greater use, or derive greater benefits from your use, of the Minudie dykelands if part of it was to be converted to freshwater marsh? _____
If yes, go to SECTION A (page 2).
If no, go to SECTION B (page 3).

2). Do you think that you might visit the Minudie dykelands for hunting if part of it was to be converted to freshwater marsh? _____
If yes, go to SECTION A (page 2).
If no, go to SECTION B (page 3).

SECTION A

3). How much greater use would you make, or what additional benefits would you derive from your use, of the Minudie dykelands if part of it was to be converted to freshwater marsh? _____

_____

4). What value would you place on these additional uses or benefits? _____

5). Do you think that any effort or money should be used to convert part of the Minudie dykelands to a freshwater marsh? _____
If yes, what would be the most appropriate organization for administering this effort or money? _____

6). If this organization asked for contributions from the public for the cost of converting part of the Minudie dykelands to freshwater marsh, which you and other members of the public could then use for free, how much would you, as an individual, be willing to contribute towards this?
Would you be willing to contribute: (circle one of the following)
$0.00 $20.00 $40.00 $60.00 $80.00 $100.00 $200.00 Other $_____

If $0.00, please explain why or check one of the following:
The freshwater marsh would have no value _____
Not able to pay _____
It's a right to say no _____
Taxes already pay for such things _____
Other _____

7). Suppose instead that an organization was interested in converting part of the Minudie dykelands to freshwater marsh, and charging a fee or admission charge for a day's use of this area. What would be the most appropriate organization to do this?
a nature organization: _____
a community board of management: _____
a private developer: _____
the provincial government: _____
other (specify): _____

In this case, what admission charge would you be willing to pay for a day's use of the area?
Would you be willing to pay: (circle one of the following)
$0.00 $20.00 $40.00 $60.00 $80.00 $100.00 $200.00 Other $_____

Please proceed to Section C.

SECTION B

8). You have indicated that you would not make greater use, or derive additional benefits from use of the Minudie dykelands, if part of the area were to be converted to freshwater marsh. However, do you think that a freshwater marsh on part of the Minudie dykelands would be useful for: (please check)

Wildlife habitat (game and fish) _____
Endangered species habitat _____
Recreation _____
Other (specify) _____

9). Do you think that any effort or money should be used to convert part of the Minudie dykelands to a freshwater marsh? _____
If no, proceed to Section C.
If yes, what would be the most appropriate organization for administering this effort or money? _____
_____

10). If this organization asked for contributions from the public for the cost of converting part of the Minudie dykelands to freshwater marsh, which would yield some of the benefits that you have noted in 8) above, how much would you, as an individual, be willing to contribute towards this? Would you be willing to contribute: (cirdle one of the following)

$0.00 $20.00 $40.00 $60.00 $80.00 $100.00 $200.00 Other $_____

If $0.00, please explain why or check one of the following:

The freshwater marsh would have no value _____
Not able to pay _____
It's a right to say no _____
Taxes already pay for such things _____
Other _____

Please proceed to Section C.

SECTION C

We would like you to answer five questions about yourself. These will be used for statistical purposes only (so that we can determine how closely our survey respondents represent the population); you will not in any way be identified.

Male or Female _____

How would you describe your family status?

a) single _____
b) married, no children _____
c) married, with children _____
d) other, no children _____
e) other, with children _____

In what range does your age fall?

a) under 20 _____
b) 20-34 _____
c) 35-49 _____
d) 50-64 _____
e) 65 and over _____

What is the highest education level you have attained?

a) grade school _____
b) some high school _____
c) high school graduate _____
d) some post-secondary _____
e) degree held _____

How would you characterize your employment status?

a) employed _____
b) homemaker _____
c) student _____
d) retired _____
e) other _____

In what range does your FAMILY income fall?

a) under $10 K _____
b) 10-19.9 K _____
c) 20-20.9 K _____
d) 30-30.9 K _____
e) 40 K and over _____

Thank-you for completing this survey.

Appendix 5

AGRICULTURALISTS
RESPONSE SHEET

Date: _____ Time:_____
Name: _____ Phone No.: _____
Hello, is this _____?
This is _____ calling about a research project that I'm helping to conduct for Environment Canada. We are researching the attitudes of farmers and other people toward wetlands in several areas across Canada. Could we have a few minutes of your time?
(If no: Record _____)
To begin, we would like your response to several questions concerning wetlands in general. Are you familiar with the term "wetland"? _____
What we mean are those areas usually called marshes, swamps, bogs, etc.
Are you currently a user of wetland areas? _____
Does your farm contain any wetland areas? _____
(If yes), do you consider these areas beneficial, useless or harmful to you?
_____
Have you ever leased any part of your property for use by hunters? _____
(If yes), for how much? $_____

In order to be specific in our survey of attitudes toward wetlands, we are considering one location in particular: the Minudie dykeland, also known as Elysian Fields.
Are you familiar with this area? _____
(If not, locate the area for the respondent:
an area of about 3,000 acres of dykeland near Minudie, that sticks out into the Cumberland Basin toward Amherst)
For the following questions, we would like you to consider a hypothetical situation where the Minudie dykeland would become a multiple use area with a managed freshwater marsh, for wildlife and recreational benefits, occupying about a third of the dykeland, next to the forested upland.
1). First of all, have you ever visited or used the Minudie dykeland for any purpose? _____
(If no, go to question 2.)
(If yes), for what purpose? _____
... how many times in the past five years? _____
Are there any other reasons for you to visit this area?
_____
2). Overall, do you think that you would gain or lose benefits if part of the Minudie dykeland was to be converted to freshwater marsh? _____
(If gain, proceed to SECTION A on page 2.)
(If lose, proceed to SECTION B on page 3.)
(If neither gain nor lose, proceed to SECTION C on page 4.)

FARM

SECTION A

3). What additional benefits would you gain from the Minudie dykelands if part of it was to be converted to freshwater marsh? _____

_____

4). What value would you place on these additional uses or benefits? _____

5). Do you think that any effort or money should be spent to administer the Minudie dykeland for multiple uses, with part of its area converted to a freshwater marsh? _____
(If no, go to Section C.)
(If yes), what would be the most appropriate organization for administering this effort or money? _____
(If no response: _____) then would you consider:
nature organizations? _____
a community board of management? _____
a farm co-operative? _____
a private developer? _____
the provincial government? _____

6). Suppose that this organization decided to charge fees to users in order to cover its costs of maintaining the area for multiple uses. In this case, what use(s) would you make of the Minudie dykeland?

_____

How much would you be willing to pay for your use(s) of the area? _____
(Note: answer in $ per day, week, month or year.)
(If $0.00 or protest, will not answer) Why?
(no extra value for you _____)
(not able to contribute _____)
(it's my right _____)
(taxes already pay for this type of thing _____)
(refuse to estimate _____)
(other (specify): _____)

(If a positive value is given above, ask:)
If the cost was (twice the given value), would you you still continue your uses of the area? _____
(If yes, then:)
If the cost was (four times the given value), would you you still continue your uses of the area? _____
etc. (Record highest willingness-to-pay: _____)

Proceed to Section C.

SECTION B

7). What benefits do you think that you would lose if part of the Minudie dykeland was to be converted to freshwater marsh? _____

_____

8). What value would you place on these lost benefits? _____

9). Do you think that effort or money should continue to be spent to maintain or improve the Minudie dykeland for its present uses? _____
(If no, go to Section C.)
(If yes), what would be the most appropriate organization for administering this effort or money? _____
(If no response: _____) then would you consider:
nature organizations? _____
a community board of management? _____
a farm co-operative? _____
a private developer? _____
the provincial government? _____

10). Suppose that this organization decided to charge fees in order to cover its costs of maintaining the area. In this case, what use(s) would you make of the Minudie dykeland?

_____

How much would you be willing to pay for your use(s) of the area? _____
(Note: answer in $ per day, week, month or year.)
(If $0.00 or protest, will not answer) Why?
(no value for you _____)
(not able to contribute _____)
(it's my right _____)
(taxes already pay for this type of thing _____)
(refuse to estimate _____)
(other (specify): _____)

(If a positive value is given above, ask:)
If the cost was (twice the given value), would you you still continue your uses of the area? _____
(If yes, then:)
If the cost was (four times the given value), would you you still continue your uses of the area? _____
etc. (Record highest willingness-to-pay: _____)
Proceed to Section C.

SECTION C

We would like you to answer five questions about yourself. These will be used for statistical purposes only (so that we can determine how closely our survey respondents represent the population); you will not in any way be identified.

Male or Female _____

In what range does your age fall?

a) under 20 _____
b) 20-34 _____
c) 35-49 _____
d) 50-64 _____
e) 65 and over _____

What is the highest education level you have attained?

a) grade school _____
b) some high school _____
c) high school graduate _____
d) some post-secondary _____
e) degree held _____

In what range does your family income fall? (emphasize "family")

a) under $10,000 _____
b) $10,000 - $20,000 _____
c) $20,000 - $30,000 _____
d) $30,000 - $40,000 _____
e) $40,000 and over _____

Thank-you for completing this survey.

APPENDIX 6
PARTICIPANTS IN PROJECT WORKSHOP

Wandlyn Inn, Amherst, 6 February, 1989

Agricultural Working Group

Dave Wilson, Environment Canada
Ralph Taylor, N.S. Farm Loan Board
Joe Cooper, Nappan Experimental Station, N.S. Agriculture
Ralph Murray, Nappan Experimental Station, N.S. Agriculture
Mike Langman, N.S. Dept of Agriculture
Zal Davar, Environment Canada
Larry Hildebrand, Environment Canada
Jane Roots, Project Research Assistant

Wildlife Working Group

Fred Payne, N.S. Dept. of Lands and Forests
Al Smith, Canadian Wildlife Service
Etta Hudgins, Nappan Experimental Farm
John Wile, Ducks Unlimited Canada
Ross Hall, N.S. Dept. of Lands and Forests
Brenda Penak, N.B. Dept. of Natural Resources
Barbara Boiduk, Project Research Assistant
Brad Walters, Project Research Assistant

Feasibility and Costs of Conversion Working Group

Joe Arbour, Environment Canada
Con DesPlanque, formerly Maritime Marshlands Rehabilitation Administration
Vernon Rodd, Nappan Experimental Farm
Keith McAloney, Ducks Unlimited Canada
Hank Kolstee, N.S. Dept. of Agriculture
Laurie Collette, N.B. Dept. of Agriculture
Jack Ryan, N.S. Dept. of Lands and Forests

APPENDIX 7

** It should be noted that Net Benefits are very approximate as they are given by the difference between two uncertain estimates: total benefits and total costs.

NOTES ACCOMPANYING TABLE 5.1 - TIDAL LAND (COSTS AND BENEFITS)
(all costs and benefits are estimated on an annual basis)

Note: Non-numerical scores shown in Tables 5.1 and 5.2 are based on the following weighting scheme from scores 0-10 assigned by the Wildlife Working Group at the project workshop.

0	- -
1/2	-
3/4	+
5/6	+ +
7/8	+ + +
9/10	+ + + +

(a) After initial construction costs of dykes and ditching, the costs of maintaining dykes and impoundments are estimated at $7/hectare. (source: notes from Workshop, Amherst, Feb. 6, 1989)

(b) Costs of maintaining access and drainage include aboiteaux maintenance, cleaning ditches, upgrading roads etc. The combined annual costs of maintaining ditching and road upkeep are estimated at $4/hectare. The cost would be the same for pasture, hay or cereal/legume production. (source: notes from Workshop, Amherst, Feb. 6, 1989)

(c) The cost of pest control on pasture is negligible.

(d) Production costs on pasture are considered to be negligible.

(e) The value of pasture used for cattle is estimated at 215 head/year (for 646 acres,unimproved pasture) with a rate of gain of 2 lbs/day for 150 days. 2 x 215 x 150 = 64,500lbs at a cost of .70/lb = 45,150.00/year. This results in a value of approximately $172/hectare. (source: Letter from H. Kolstee, Feb. 14, 1989)

(f) The need for fertilizer, nutrients, and soil amendments, etc. depends on the individual soil properties, topography and location of each farm, as well as farmer preferences. Costs for agricultural production on dykelands are estimated from figures found in the Farm Management Fact Sheet, 1986-102: Hay production based on a five year rotation. The cost includes the following:

$ 3.74	Spreader (incl. ins., reps., int., and depr.)
$ 10.37	75hp tractor (incl. ins., reps., int., depr.)
$ 2.79	fuel and lube
$ 3.90	labour
$ 18.65	lime
$ 39.45	total/hectare

Added to this is the cost of fertilizer based on an average price of .30kg as stated in the Farm Management Fact Sheet. The estimated use of fertilizer on dykelands is 100lbs/acre or 122kg/hectare. This results in a cost of $33.68/hectare for fertilizer. Therefore, the total cost of soil inputs for hay production is $73.13/hectare.

(g) Pest control for hay production includes the following costs:

$ 2.79	sprayer (incl. dep., ins., int., rep)
$ 1.38	tractor (incl. dep., ins., int., rep)
$ 0.46	labour
$ 0.33	fuel and lube
$ 1.58	materials
$ 6.54	total/hectare (source: Farm Management Fact Sheet 1986-102)

(h) Hay production costs include the following:

$122.43	average harvesting costs (includes labour)
$ 26.25	average overhead costs
$364.40	average fixed costs (incl. tax, depr. etc.)
$513.08	total/hectare (source: Farm Management Fact Sheet 1986-102)

(i) Commercial value of hay production is based on an average farm price of $62/ton (1988). The yield from dykeland soils is estimated at 4 tons/acre or 9.8 tons/hectare. This gives a value for hay production of $607/hectare. (source: Nova Scotia Agricultural Statistics, 1988) However, it is important to note that the majority of hay produced is used 'on-farm' and therefore, may have a higher value than $62/ton.

(j) The need for fertilizer, nutrients and soil amendments depends on the individual soil properties, topography and location of each farm, as well as farmer preferences. Costs for cereal/legume production on dykelands are estimated from figures for corn silage found in the Farm Management Fact Sheet, 1986-101

$ 1.35	Spreader (incl. ins., reps., int., depr.)
$ 3.55	75hp Tractor (incl. ins., reps., int., depr)
$ 1.55	fuel and lube
$ 16.52	lime
$ 56.65	total/hectare

Added to this is the cost of fertilizer based on an average price of .30kg as stated in the Farm Management Fact Sheet. The estimated use of fertilizer on dykelands is 100lbs/acre or 122kg/hectare. This results in a cost of $33.68/hectare for fertilizer. Therefore, the total cost of soil inputs for corn silage is $90.33/hectare.

(k) Cost of pest control for cereal/legume production (based on corn silage estimates) includes the following:

$ 5.17	sprayer (incl. dep., rep., ins., int.)
$ 3.35	tractor (incl. dep., rep., ins., int.)
$ 2.29	labour
$ 1.64	fuel and lube
$53.88	materials
$66.53	Total/hectare (source: Farm Management Fact Sheet 1986-101)

(l) Cereal /legume production costs are estimated on figures for corn silage and include the following:

$112.06	average harvesting cost (includes labour)
$ 31.00	average overhead costs
$473.29	average fixed costs (incl. tax, depr. etc)
$616.35	total/hectare (source: Farm Management Fact Sheet 1986-101)

(m) The commercial value for cereal/legumes was determined using figures for corn estimated at an average farm price of $93/ton, an average yield per hectare of 12 tons, giving a commercial value of $1116/hectare. (source: Nova Scotia Agricultural Statistics, 1988) However, it is important to note that corn silage production on dykeland often does not produce high yields unless it is on very well drained soil. Poorly drained dykeland soils require longer periods in the spring to thaw and drain, decreasing the growing days available to corn production.

(n) Cost of maintaining access and drainage on a sod farm after initial construction is approximately $247/hectare (source: notes from R. Murray, N.S. Agriculture and Marketing, Nappan, Feb. 20, 1989)

(o) Cost of seed and fertilizer on a sod farm are estimated at $741/hectare. (source: notes from R. Murray, N.S. Agriculture and Marketing, Nappan, Feb. 20, 1989)

(p) Cost of pest control on a sod farm would include the use of herbicides and is included in the cost of mowing, estimated at $494/hectare. (source: notes from R. Murray, N.S. Agriculture and Marketing, Nappan, Feb. 20, 1989)

(q) Cost of labour and production would include harvesting and irrigation, totalling approximately $1420/hectare. (source: notes from R. Murray, N.S. Agriculture and Marketing, Nappan, Feb. 20, 1989)

(r) The value of sod production is estimated at $5928/hectare. (source: notes from R. Murray, N.S. Agriculture and Marketing, Nappan, Feb. 20, 1989)

(s) The costs of maintaining the dykes and impoundments for a freshwater marsh would be equal to that of maintaining dykes for other uses, although there would be extra costs in managing the impoundments for drawdown etc. The cost for this maintenance is estimated at $12/hectare. (source: notes from Workshop, Amherst, Feb. 6, 1989)

(t) Costs of maintaining freshwater marsh include water level and vegetation management estimated at $70/acre or $172/hectare. (source: letter from K. MacAloney, Feb. 8, 1989)

(u) Labour costs for a freshwater marsh relate to the cost of muskrat harvesting. Figures for this have not yet been obtained.

(v) Commercial values derived from freshwater marsh are primarily related to muskrat harvesting, although other animals such as mink and raccoon are harvested as well. Muskrat harvest is estimated at 7.5/acre/year or 18.5/hectare/year with an average value of $5 each. This gives a value of $92.60/hectare. (source: Letter from K. MacAloney, Feb. 8, 1989)

(w) Other consumptive use benefits on freshwater marsh include waterfowl production, estimated at 1 brood (6 flying ducks) per 3 acres or 5 ducks/hectare. Ducks Unlimited values ducks at $21 each. Therefore, a value for other consumptive uses (ducks) is $105/hectare.

(x) The classification of 'non-consumptive use benefits' (11) includes non-consumptive recreational activities.

(y) The classification of 'other benefits not included above' (12) includes maintaining ecosystem processes, both ecological and hydrological.

NOTES ACCOMPANYING TABLE 5.2 - UPLAND (COSTS AND BENEFITS)
(all estimates are presented as annual costs)

(a) Costs for access and drainage are primarily one time costs.

(b) Labour and other production and maintenance costs will vary depending on location, topography, soil properties, product, and market. Much of the cost of upland agricultural production related to initial clearing, levelling, draining, and stone removal. Once this has been done, yearly maintenance costs are similar to those of tidal lands.

(c) Cost of pest control on pasture is considered to be negligible.

(d) The value of pasture used for cattle is estimated at 215 head/year (for 646 acres, unimproved pasture) with a rate of gain of 2 lbs/day for 150 days. 2 x 215 x 150 = 64,500lbs at a cost of .70/lb = 45,150.00/year. This results in a value of $172/hectare. (source: Letter from H. Kolstee, Feb. 14, 1989)

(e) The costs of fertilizer, nutrients and soil amendments related to hay production are dependent upon the individual farmer and the soil properties of each farm.

$ 3.74	Spreader (incl. ins., reps., int., and depr.) Average costs include:
$ 10.37	75hp tractor (incl. ins., reps., int., dep.)
$ 2.79	fuel and lube
$196.20	materials
$ 18.65	lime
$221.75	total/hectare (source: Farm Management Fact Sheet, 1986-102: based on a five year rotation)

(f) Control of pests in hay production depends largely upon location and individual site characteristics. Average costs include:

$ 2.79	Sprayer (incl. int., ins., depr., reps)
$ 1.38	tractor (incl. int., ins., depr., reps)
$ .33	fuel and lube
$ .46	labour
$ 1.58	Materials
$ 6.54	total/hectare (source: Farm Management Fact Sheet, 1986-102, based on five year rotation)

(g) Labour and production costs will decrease with decreasing intensity of agricultural production. Average costs include the following:

$122.43	average harvesting costs
$ 26.25	average overhead costs
$364.40	average fixed costs (incl. tax, depr. etc.)
$513.08	total/hectare (source: Farm Management Fact Sheet, 1986-102, based on hay production, five year rotation)

(h) Commercial value of hay is based on 1988 data of an average yield of 3tons/acre and an average farm price of $62/ton. This gives a value of $460/hectare. (source: Nova Scotia Agricultural Statistics, 1988)

(i) The cost of fertilizer, nutrients and soil amendments for cereal/legume production (based on corn silage figures) include the following:

$ 1.35	Spreader (incl. ins., reps., int., depr.)
$ 3.55	75hp Tractor (incl. ins., reps., int., depr)
$ 1.55	fuel and lube
$131.10	materials
$ 16.52	lime
$154.07	total/hectare (source: Farm Management Fact Sheet, 1986-101)

(j) Costs of pest control for cereal/legume production (based on corn silage figures) include the following:

$ 3.55	75hp Tractor (incl. ins., int., dep., reps)
$ 5.17	Sprayer (incl. int., ins., depr., reps)
$ 1.64	fuel and lube
$ 2.29	labour
$ 53.88	materials cost
$ 66.53	Total/hectare (source: Farm Management Fact Sheet, 1986-101)

(k) Costs for cereal/legume production (based on corn silage figures) include the following:

$112.06	average harvesting costs, including labour
$ 31.00	average overhead costs
$473.29	average fixed costs
$616.35	total/hectare (source: Farm Management Fact Sheet, 1986-101)

(l) Commercial value of cereal/legume production (based on corn figures) is based on an average yield of 12tons/hectare and an average farm price of $93/ton. This gives a value of approximately $1116/hectare. (source: Nova Scotia Agricultural Statistics, 1988)

(m) The cost of maintenance of a freshwater marsh would include vegetation control at a cost of $70/acre or $172/hectare. (source: Letter from K. MacAloney, Feb.8, 1989)

(n) Pest control in a freshwater marsh might include trapping predators but costs are considered to be minimal.

(o) Labour production costs for muskrat harvesting have not yet been obtained. Labour and other production costs for freshwater marsh may vary depending upon use of the area.

(p) Commercial values derived from freshwater marsh are primarily related to muskrat harvesting, although other animals such as mink and racoon are harvested as well. Muskrat harvest is estimated at 7.5/acre/year or 18.5/hectare/year with an average value of $5 each. This gives a value of $92.60/hectare. (source: Letter from K. MacAloney, Feb. 8, 1989)

(q) Other consumptive use benefits on freshwater marsh include waterfowl production, estimated at 1 brood (6 flying ducks) per 3 acres or 5 ducks/hectare. Ducks Unlimited values ducks at $21 each. Therefore, a value for other consumptive uses (ducks) is $105/hectare.

(r) The classification 'non-consumptive use benefits' (11) includes non-consumptive recreational activities.

(s) The classification 'other benefits not included above' (12) includes maintaining ecosystem processes, both ecological and hydrological.

Appendix 8

FORM A: SITE DOCUMENTATION (Page 1 of 2)

Part 1 - Background Information

Evaluation Site: Minudie (hypothetical wetland) Date: March 12, 1989

Site Location (Section, Range, and Township): 5km S.W. Amherst, Cumberland County, N.S.

Has the evaluator taken a training course in WET Version 2.0? No

Agencies/Experts Contacted: CWS, Ducks Unlimited Canada, N.S. Lands and Forests

Circle the assessment levels to be completed? (SS-1) (SS-2) (E/O-1&2) E/O-3 HS

Is the wetland tidal or (nontidal)? If the wetland is nontidal, indicate the month(s) that represent wet, dry, and average conditions, or if only average annual condition will be used, give rationale. Also, indicate if the previous 12 months of precipitation has been above, below, or near normal.
High precip. all months except July and August when it is expected to cause a fall in water levels, although the majority of the wetland is expected to be permanently underwater.

Is this evaluation an estimate of past conditions or a prediction of future conditions? (If answer is yes, explain nature and source of predictive data.)
Prediction of future conditions. The marsh is hypothetical in that it does not yet exist but could be developed specifically for the conservation and enhancement of wildlife. Considerable data exist on similar managed wetlands in the region.

Will alternative ratings be used to evaluate any of the functions or values (if yes, explain)? Wildlife values are estimated from professional opinion (there exists a considerable professional knowledge base of the region under study.) Golet scores may also be applied for measures of wildlife.

Part 2 - Identification and Delineation of Evaluation Areas

Sketch a map on the following page, or attach a suitable map (photocopy of topgraphic map) that shows the following information:

-- Boundaries of the AA, IA, and IZ, and the location of service areas.
-- Watershed boundaries of AA, and service areas.
-- Extent of surface water in the AA during the wet and dry seasons.
-- Open water (channels and pools) within and adjacent to the AA.
-- Normal direction of channel or tidal flow
-- Normal direction of wind-driven waves or current.
-- Impact area(s).
-- Scale of distance and north compass direction.

Explain the procedures used to identify or delineate the AA, IA, IZ, service areas, and the watersheds of these areas if they differed from the guidelines outlined in Section 2.7.
The assessment area follows approximately the proposal for a managed fresh water wetland as designed by Mr. Kieth MacAloney of Ducks Unlimited Canada (Amherst, N.S.).

-- Continued --

FORM A: SITE DOCUMENTATION (Page 2 of 2)

Part 2 (Cont.)

Estimate the extent of the following areas:

Assessment Area = 260 ~~acres~~x ha
Impact Area = N/A acres (only if applicable)
Watershed of AA = 410 ha ~~acres~~/ 4.1 ~~miles~~km^2 (acres x 0.0016 = miles)
Wetlands in AA = 260 ha ~~acres~~
Wetlands in the watershed of closest service area = NONE acres
Wetlands and deepwater in the watershed of closest service area = NONE acres

How were locality and region defined for this evaluation?
Locality - Minudie Point (refer to map)

~~Region - Chignecto Coastal Lowlands area~~

Sketch of Evaluation Areas (or attach map):

Map attached

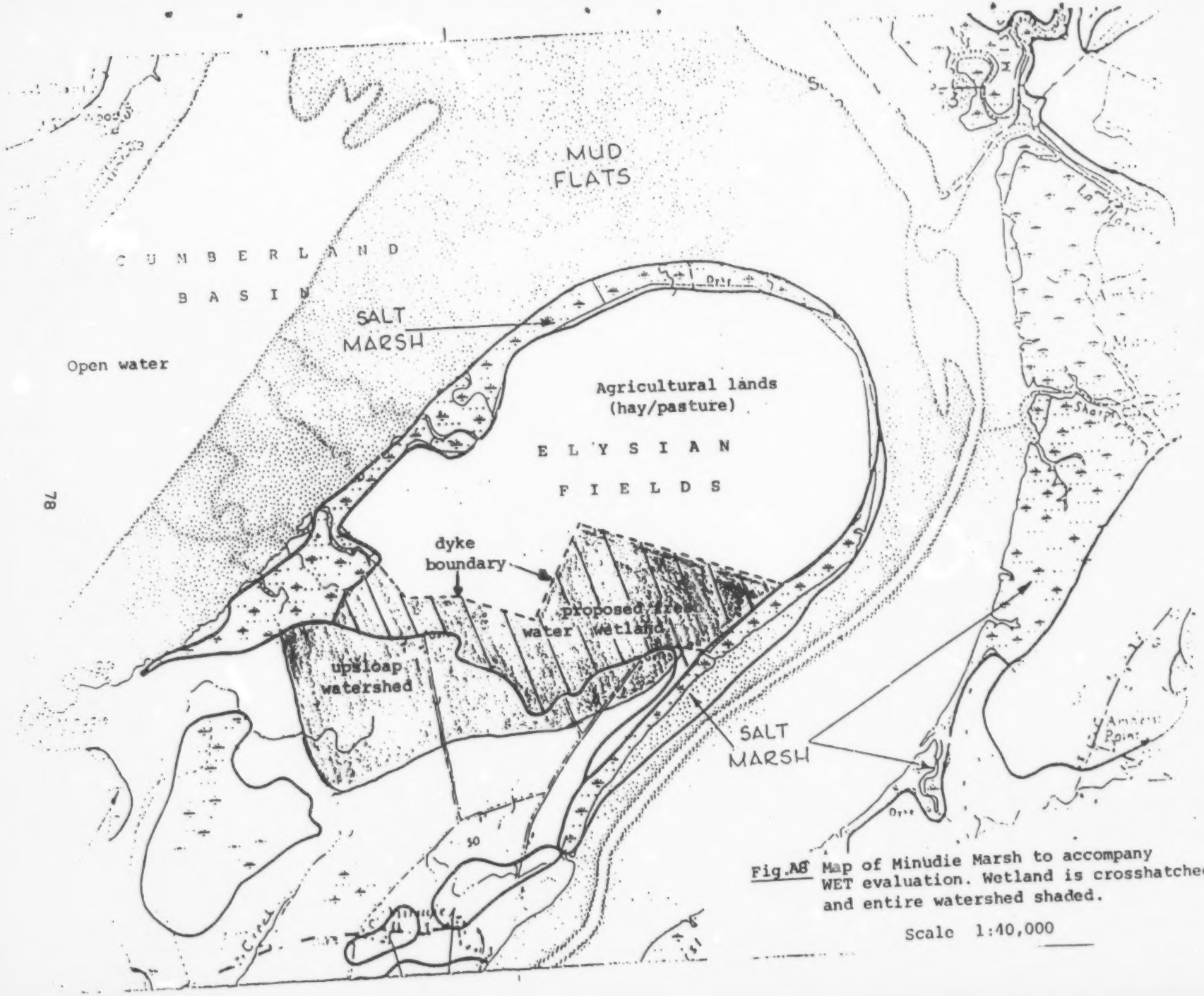

Fig.A8 Map of Minudie Marsh to accompany WET evaluation. Wetland is crosshatched, and entire watershed shaded.

Scale 1:40,000

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